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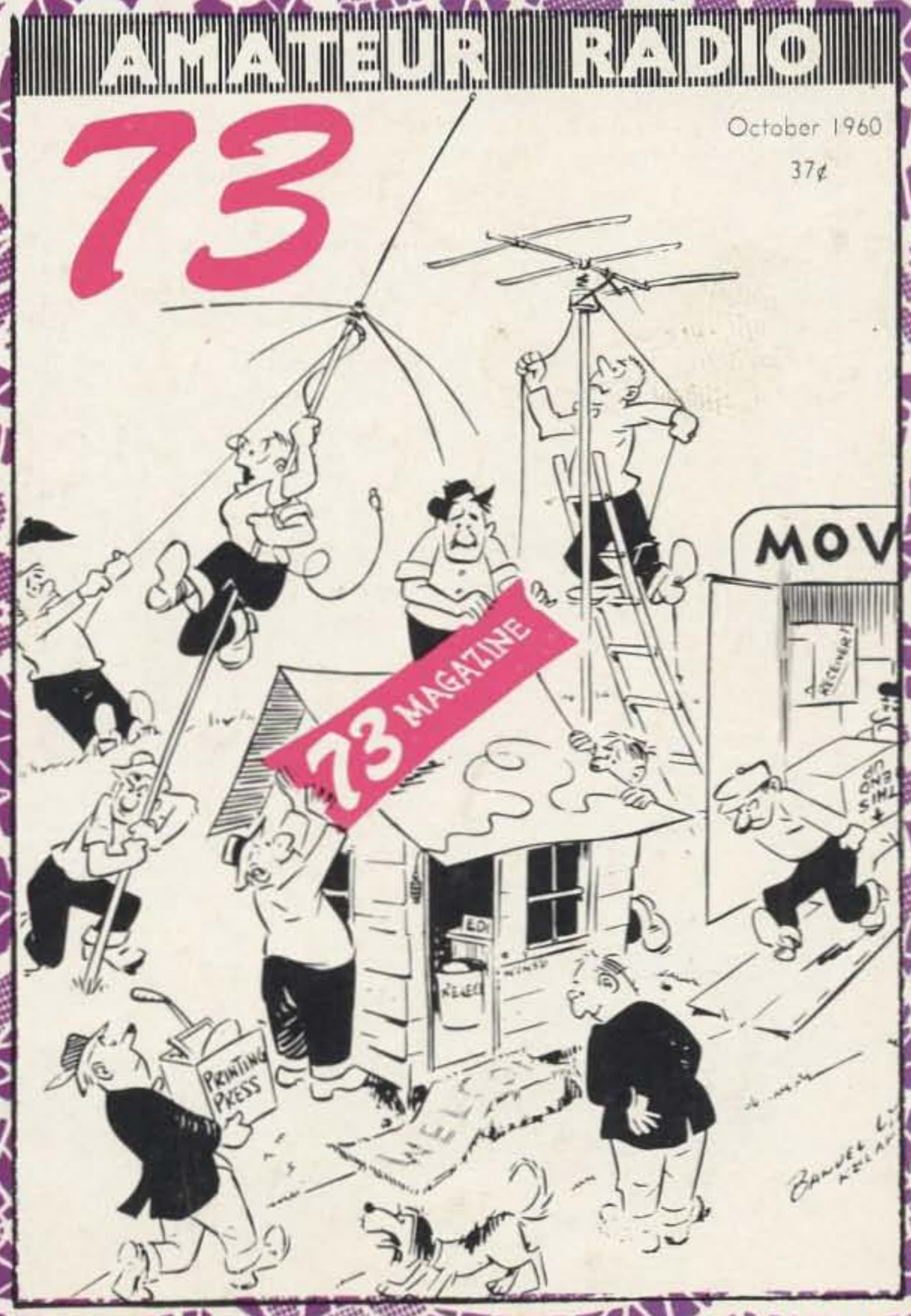

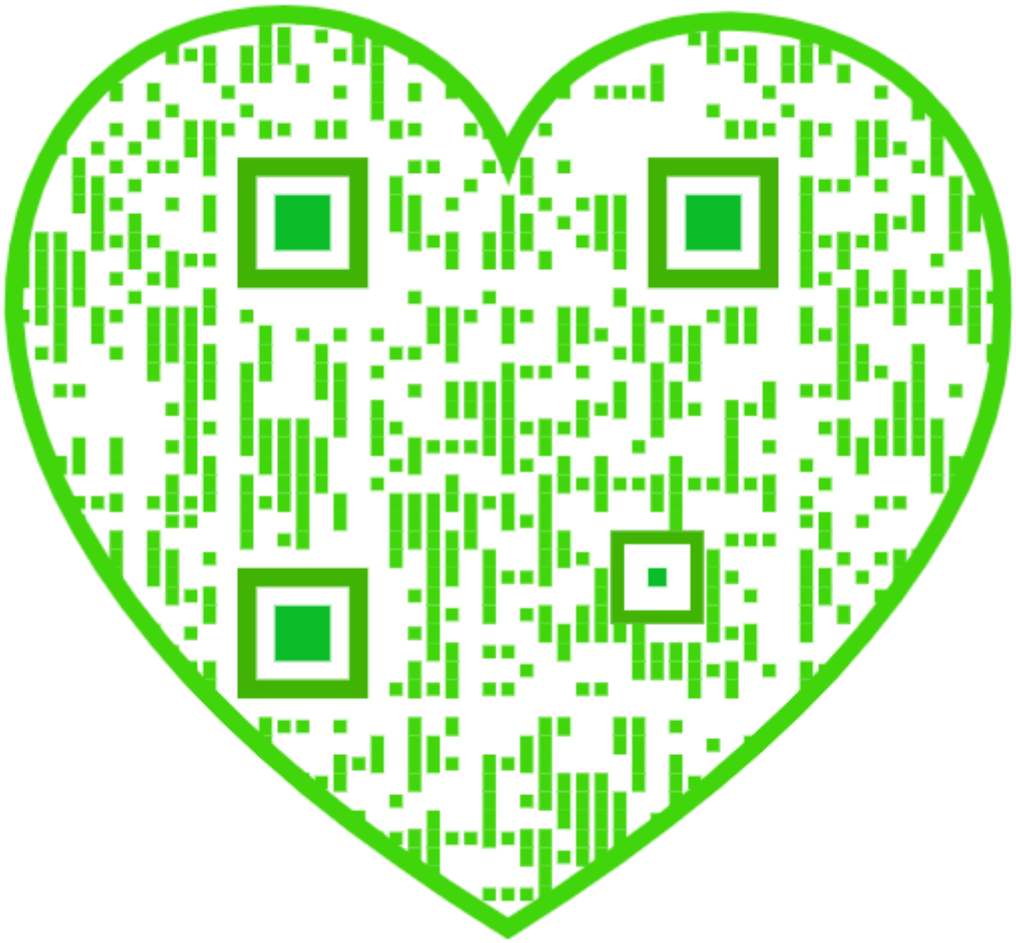

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Gravity Waves
Solution to Vietnam?
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...de W2NSD/1

Wayne Green

Gravity Waves

My thanks to old friend Neil W2OLU for sending in a clipping from the New York Times announcing that Professor Weber of the University of Maryland has detected gravitation waves. The existence of gravitational radiation is predicted by Einstein's General Theory of Relativity and Professor Weber believes that he has experimentally verified Einstein's prediction.

A century ago Maxwell predicted from mathematical calculations that there were other types of electro-magnetic radiation than light rays. In 1888 Hertz confirmed Maxwell's predictions and opened the radio spectrum.

As I mentioned a few months ago, here is a field that is wide open for the amateur. There are no professionals in the field yet. What, all of us want to know, is the velocity of propagation of a gravity wave? Speed of light? Instantaneous? If it is faster then it would make a wonderful communication medium for interstellar contacts . . . and might explain how those pesky UFO's are able to get here from planetary systems so far away that reputable scientists say that they cannot exist just because there is no possible way for them to come that distance.

If you have any info to pass along on gravity generators or detectors, let's pass it along through 73.

Vietnam Solution?

The educated opinion seems to be that President Nixon has been hoping that he could use the same route for settling the war that Eisenhower used for closing out the Korean conflict. That meant working through Moscow, who, because of the Chinese difficulties, were supposed to be anxious to accomodate the U.S.

This approach doesn't seem to have worked out in practice at all, a situation which leaves us still boiling in our own kettle of soup. Unilateral disengagement means, essentially, the slaughter of most of South Vietnam, the historic consequence of losing a war in Asia. This, in turn, can hardly help the non-communist forces in Laos, Thailand, Cambodia, Malaysia, Burma and India. Any promises we have made in the past of help will hardly be honored after the disaster in Vietnam, and they know this.

Obviously, getting out of Vietnam unilaterally is a very bad solution to our problems. Should we then turn around and escalate again? We have seen that the communists are able to match every escalation. They have no intention whatever of losing the war. They have been at it for many years there and are not about to drop it now.

This is a subject that can better be argued in a book-length form than a brief editorial comment such as this, however I would like to make an abbreviated suggestion for a new course of action that might possibly prove more rewarding. I wrote about this a couple years ago upon my return from Asia, but not much came of it. The ideas still seem quite valid . . . perhaps even more valid than ever, since more options have been tried in the meanwhile without noticeable success.

Basically, I propose that the Pentagon and the State Departments do not have a corner on the U.S. brain market. Experience has rather indicated negatively in this respect. Possibly then, we could do better than depend upon them for our total effort in Vietnam, directing the fighting and peace talks, which about sums up our activities there.

Just suppose that we decided to fight a much more basic fight, using our biggest weapon? The bomb? No, not at all. The battle between communism and capitalism is

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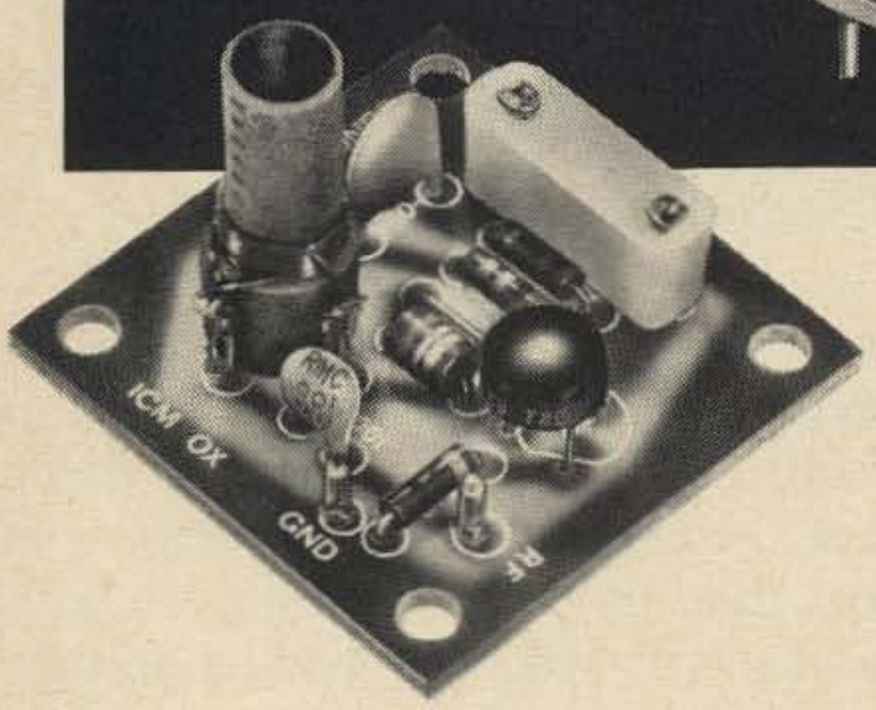

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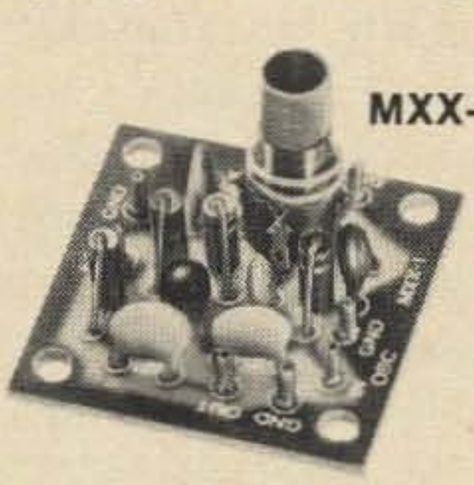

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most fundamental. Why not use capitalism as a weapon? This is one weapon that has been almost irrestible so far and yet we have made little effort to use it.

For a fraction of the $100 million a day we are spending in Vietnam we could ship production machinery from the U.S. to set up factories around Vietnam. I envision a change from the present agricultural system to a half agricultural, half industrial system, with factories spread out so that workers can continue to farm part time. I wonder if this isn't a happier way of living than our all-or-nothing arrangement?

Factories in undeveloped countries are rather basic affairs and far less expensive than those in our country. With a relatively small investment we could spread factories all over Vietnam, providing jobs part time in hundreds of villages. Would the people make the change? If the incentive is there, they will. The incentive that I have seen change one country after another into industrial countries has been the availability of inexpensive cars and television sets. People will work incredibly hard for these pleasures.

Suppose we set up a few dozen factories making prefab huts and basic furniture and gave these products to the Vietnamese, along with a small plot of land for a garden? Not only would we be able to clean up the miserable camps now housing thousands of refugees, but we would also have something very interesting to offer defectors from the North. Cars, TV, and other luxuries would have to be earned.

The whole bill for a give-away program like that might come to $1000 per defector, but that is a small fraction of what we are paying right now to try and kill them as they come down to fight. It is costing us some 500 times that much!

Once we convert Vietnam to a capitalistic system, they will be forever broken away from the old patterns and can soon take their place among those Asian countries who have made the change . . . Singapore . . . Thailand . . . Japan. There are plenty of markets in Asia for products manufactured in Vietnam since few of the neighboring countries are developed.

Does that sound better than the alternatives of fight harder or quit?

Danger

As those of you who know me personally know, I love to eat and as a result I am generally a bit on the heavy side. Every couple of years or so I go on a diet and take off the accumulated layer. This summer, egged on by the wonders of the Doctor's Diet, a lovely invention wherein you eat meat and drink water. . .and not much else, I decided to make the plunge. The book said that I could also drink all of the diet soda I wanted along with the diet, so I loaded up on my favorite flavors of "tonic," as they call it up here in New Hampshire, all sugar free.

Fat free beef and fat free chicken left me with plenty of hunger pangs, but the diet soda filled up the empty spaces and I found that I was drinking more and more each day, getting up to some four bottles a day. No harm done, so why not?

Along about the third day I began to find it difficult to focus my eyes and I started having periods of vertigo. This got progressively worse and by the seventh day I couldn't even see to type, much less read manuscripts and proof-read articles. My eyes just couldn't focus any more at all. I realized that meat certainly wouldn't do this to me, and since the only other thing I was eating was diet soda, it obviously had to be that. I stopped.

Within a couple of days the headaches stopped, the vertigo stopped and my eyesight began to improve. After a week I could read medium-sized print again and type.

The secret was right there on each bottle, if I had taken the time to read the fine print while my eyes were still working. That stuff is supposed to be only for people who have been requested by a doctor to restrict their intake of sugar . . . diabetics. In moderation I suppose it would not cause noticeable difficulty. Who would notice his eyes slowly deteriorating over a period of weeks or months and tie it in with diet soda? Even occasional headaches and vertigo might not be suspected. And who knows what other damage these beverages may be doing? They certainly must be able to have a profound effect on the human body to be able to do me in so quickly on such a small dose.

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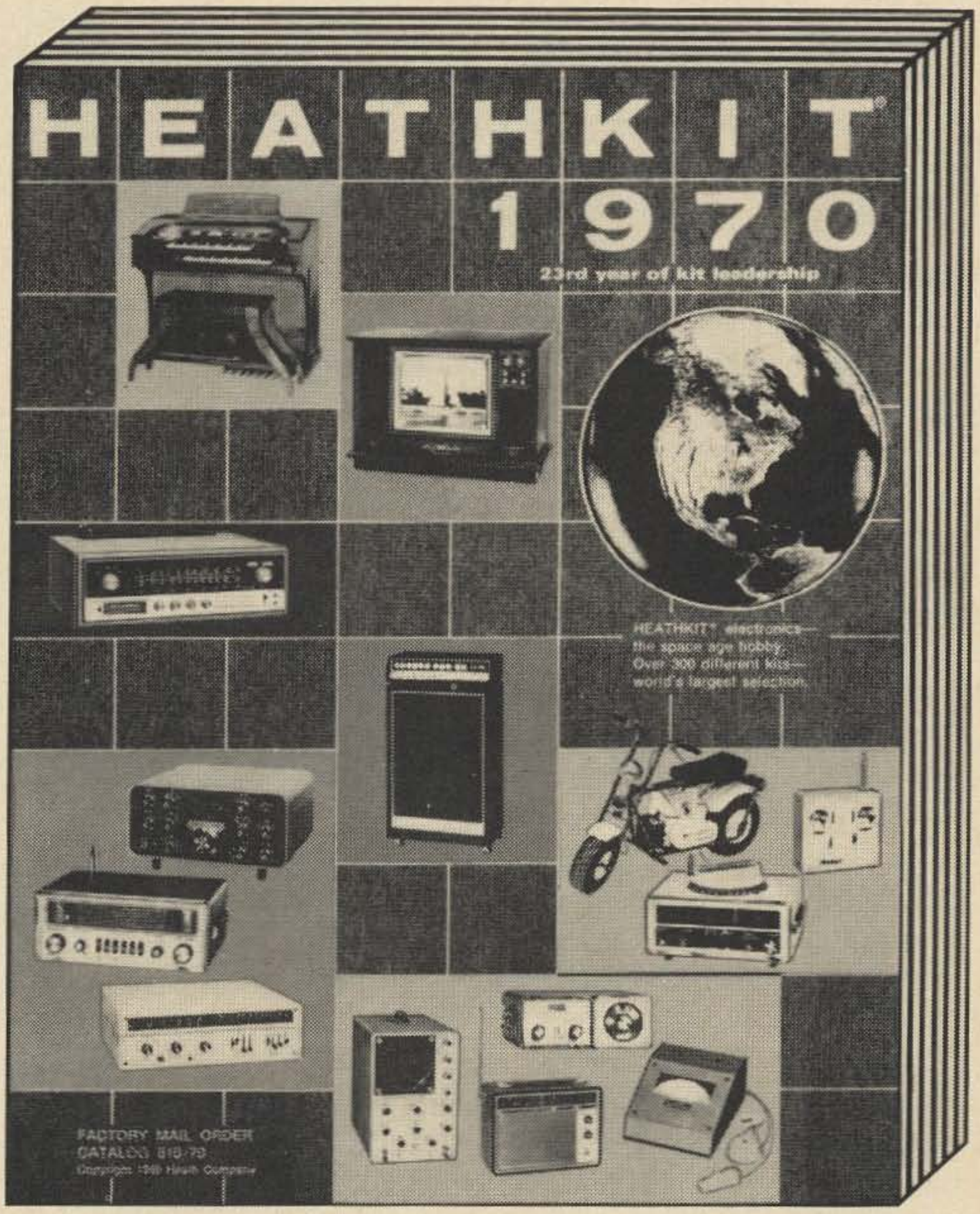

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Extra Income

When people explain to me that they are too short of money to buy a subscription to 73 I look at them in wonder. Short of money! That is truly remarkable in this day when there are so many simple ways of making money in spare time. The money is there for those that are willing to go after it.

There are so many things to sell and so many services to offer that there should be something for everybody. If you live in an area where you can make unlimited local phone calls at no extra charge, you have a goldmine. You can sell products or services over the phone.

Take for instance selling magazine subscriptions. Most families buy at least one magazine subscription and some buy as many as a hundred a year. Why should all these people buy their subscriptions directly from the magazines when they could just as well buy them through you and save money for themselves?

How do you get started in something like this? Well, first I would write letters to the circulation managers of the larger circulation magazines on some quickly made letterhead. If letterhead costs too much, make your own with a rubber stamp on blank paper. You can be in business for about $2 as the Amalgamated Subscription Agency. You can find the magazine office addresses on the magazine masthead at your local newsstand.

Once you have some of those juicy subscription agent prices in hand you can start calling people right out of the phone book and quote them a price on buying a new subscription or extending their current subscription to Life, McCalls, Reader's Digest, etc. Once you get them for a customer you naturally keep track of their subscriptions and give them a call when renewal time comes along. Ask them for a list of the magazines they read and write to the other publishers too. Before long you will be an agent for hundreds of publishers.

You can find out about special interests locally too. Just as you can get a list of customers from a radio parts store which will help you sell radio magazines, also you can get names from a sporting goods store for selling sporting magazines, from a camera store to sell photography magazines, and from the sports car garage to sell car magazines. You can build up lists of dozens of special interests for magazine sales.

Do I have any other money-making ideas? Sure, plenty. You're interested in electronics, so how about selling some electronic equipment? Have you ever thought about selling closed circuit television installations in your area? Many businesses and even homes are excellent sales prospects for them. Or how about selling one of those radar alarm systems to the store owners locally?

There are thousands of things to sell. You can sell direct from your home, over the phone, or even act as a manufacturer's representative to sell items to local retail stores. The magazine Salesmen's Opportunity lists more products looking for salesmen than you can imagine. The Macfadden .50 book on *How To Make A Fast Buck* will give you hundreds of more ideas. Most of the companies that do public surveys are in need of help from the hinterlands and the pay is sometimes surprising.

One of the biggest skin diving stores in the country sprang from a small bedroom in the wilds of Brooklyn. The enterprising high school student rubber stamped up some letterhead and became a dealer for several manufacturers. Low overhead meant bargains for the customers and before long his parents were being crowded out of the house. Stop in and say hello to Harvey for me the next time you visit Sheepshead Bay.

One of the biggest ham radio distributors in the country started out not many years ago in a little corner of his father's furniture store. Does that give you any ideas?

Wealth?

A few months back there was a very snide reference in one of the other ham magazines to a little booklet I wrote a couple years or so back on *How To Make a $1,000,000.* I've

mentioned this briefly in my editorials before, I realize, explaining that my interest in the matter is more academic than real.

This academic interest does lead me to read most of the books that come out on the subject of making money or keeping it, once you've made it. And that can be a problem too. In addition to the book by Lloyd Colvin W6KG on making a million in the home construction business, I might also recommend the pocket books on *The Rich and The Super Rich,* and *Atlas Shrugged*. The first of these was particularly interesting to me because it backed up my own deduction that college education not only does not help you to make big money, it in fact is a severe hindrance.

Fortunately for our school system very few people seem to be even slightly interested in going for the big money. By big money I mean enough to permit you to retire and live comfortably from the invested capital, not millions of dollars.

Fortunes are not being *made* any more, just inherited. However, thanks to inflation, it is not at all difficult to gather together one little bitty million. This is being done quite frequently by those either shrewd enough to figure out the system or those lucky enough to fall into it. I suppose I should add a third group that ignore the system and get there by stealing.

Even considering Parkinson's Second Law (expenses will always rise to meet income), $1 million dollars invested at a mere 5% should last you rather well. You won't be a big yacht customer or buy a Rolls, but at $50,000 per year the wife shouldn't have to buy cloth coats for winter.

Naturally I recognize that the preponderance of 73's readers are inescapably committed to their present life and that any discussion of a career is, for them, quite academic. On the other hand, few of us are not occasionally put in the position of being able to influence a younger person, so perhaps a bit of thinking about careers and the future is not entirely out of line.

It is all too easy to try to pass along the values that we have been taught. I accepted without hesitation the idea that everyone that could should go through college. It never even occurred to me to question this. I think I have the matter in better perspective now.

A college education, complete with Master's degree, is worth every dollar and day to the fellow who wants to work for a large company for the rest of his life. The pay is good and the life is American Standard. Of course it means buying most of the big things on time payments for many, many years. The house will never be paid for, since advancement in business means moving into a bigger house every few years with attendant refinancing. Add car payments, boat payments, vacation payments, etc..

That little postcard from Cleveland Institute that we bind into 73 every now and then got me to thinking. I detest those darned things, but as a publisher I have to recognize the economics of my business and run them now and then. At any rate, I sent in one to Cleveland and in a few days one of their nice four color brochures arrived. The cover letter asked me, "Where do you want to be in life in one year . . . in two years . . . in three years from now?

My own plans are formulated, but I wonder how many of the younger amateurs have done much thinking about their future?

There are, obviously, many fortunes to be made in electronics. It is one of the fastest growing fields in the world today. This means opportunity. The big corporations will get bigger, naturally, but thousands of little companies will blossom out and make small fortunes for their entrepreneurs. The little booklet that I wrote on making a million dollars explains a very simple method of taking advantage of this growth, starting out with nothing and getting over the hump in a very few years.

One does not become a successful businessman by starting his own business any more than a concert pianist succeeds by going on stage with no experience whatever. Success requires a lot of hard work and luck. And the harder you work the luckier you get.

Something else has changed with the generations too, I suspect. It may be my own special background, but in my youth it was not looked down on as a goal to work for wealth. Now, when talking with teen-

continued on page 126

A Super-Gain Antenna for 40 Meters

Ed Dusina, W4NVK
571 Orange Avenue West
Melbourne, Florida 32901

This article gives briefly the results of a study to develop an antenna for the 40 meter band which would allow the hams to compete somewhat better with the foreign broadcast stations which practically take over the band in the evening and nighttime. In this respect the study was a partial success in that an antenna was developed based on the theory of super gain arrays, which rejects QRM from low angles. After some experimental work, a super gain antenna[1] was designed for the 40 meter band which is extremely simple, uncritical and offers large gain and QRM rejection factors.

The propagation studies and design work for this antenna were done at Dusina Enterprises in Melbourne, Florida.

Briefly, the antenna to be described has a forward gain of approximately 9 DB based upon engineering design data developed in the literature[2] and in addition to the forward gain has an average of 15 DB rejection against low angle QRM. Therefore, two hams both using this type of antenna array can gain an advantage of about 14 DB[3] improvement in signal strength and about 15 DB less QRM when communicating via high angle paths over short skip distances for an overall S/N improvement of about 29 DB. Short skip distances on the 40 meter band mean up to about 200 miles radial distance from the transmitter in the daytime and up to about 1,000 miles in the nighttime. These distances are selected from actual performance measurements on the array to be described.

The antenna is of the super gain class and consists of a single dipole antenna placed very close to and above a reflecting screen such as to limit the radiation to 90 degrees plus or minus 35 degrees approximately. The antenna is made in a very simple manner as follows. A 300 ohm TV type twin lead folded dipole is cut to the length 63 feet 2 inches plus or minus 1 inch and is fed in the center with RG 58 U coax or some other 50 ohm coaxial cable. This folded dipole antenna is suspended tautly seven feet above flat ground using three wooden poles or some other suitable support. If metallic poles are used, it is suggested that nylon cord be used for approximately three or four feet between the ends of the antenna and the metal pole so as to reduce the effect of capacitance on the ends of the antenna. On the ground directly below this antenna are laid three reflecting wires of a noncritical length sixty-five to eighty feet long. One wire is stretched along the ground directly below the antenna element. One of the remaining wires is laid along the ground parallel to the antenna but approximately six feet from the wire directly beneath the antenna. The third reflecting wire is placed on the other side of the antenna such that when the reflecting screen is completed there are three wires six feet apart, one under the antenna and one on each side forming a reflecting screen about eighty feet long by twelve feet wide. These reflecting wires are laid on top of the ground but they may be in the ground if desired. A slightly higher efficiency will result if they are placed on top of the ground, and the method used here over a lawn was to cut the lawn very low and lay the wires on top of the grass. When the grass grows back out, the wires will stay under the turf and not be

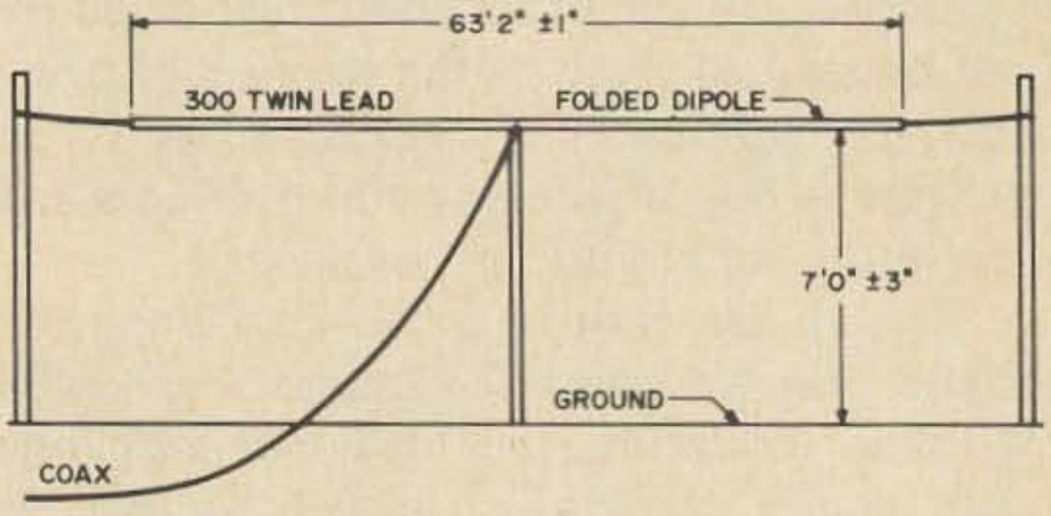

Fig. 1. Super-gain 40 meter skywire.

bothersome. The ends may be wrapped around large nails and the nails driven into the ground to assure that the reflectors do not curl up on the ends. Any reflector wire size larger than about No. 26 will be adequate, and larger than No. 14 is being wasteful.

As can be seem from the foregoing description, this antenna is sufficiently simple that every radio amateur can construct one. Although this antenna is intended to be used mostly for short-range communications up to about 200 miles, due to the nature of the 40 meter band, short skip conditions prevail much of the time at night and the antenna is then effective for distances of 1,000 miles and sometimes more with full gain.

An antenna constructed in accordance with the directions given above yields the following VSWR when fed with a 50 ohm coaxial cable. The antenna measured was fed by 100 feet RG-58 cable, used No. 26 wire reflectors and was tested at 2,000 W PEP:

FREQ	7.0	7.1	7.2	7.25	7.3	7.4
VSWR	3.6	2.6	1.3	1.05	1.5	3.0

Propagation Effects

Tests conducted in Florida on the effectiveness of this antenna in improving communications capabilities on the 40 meter band revealed significant improvement of an amount unexpected before the tests were made. These tests revealed the following characteristics:

Daytime Use

Typical daytime results comparing the super gain antenna to a two element collinear array with 2 DB[4] gain and elevated sixty feet above the ground (maximum radiation at 35° elevation) gave the following comparisons.

Stations from Alabama received at Melbourne, Florida, were typically 10 DB stronger on the 60 foot antenna than they were on the super gain array. This communication was at a distance of about 500 miles, which is long skip (about 35° arrival angle) for daytime 40 meter conditions. At approximately the same time, stations in North Carolina, a distance of about 700 miles, were 6 DB stronger on the high antenna than on the super gain array, while stations in Tennessee, approximately 700 miles distance,

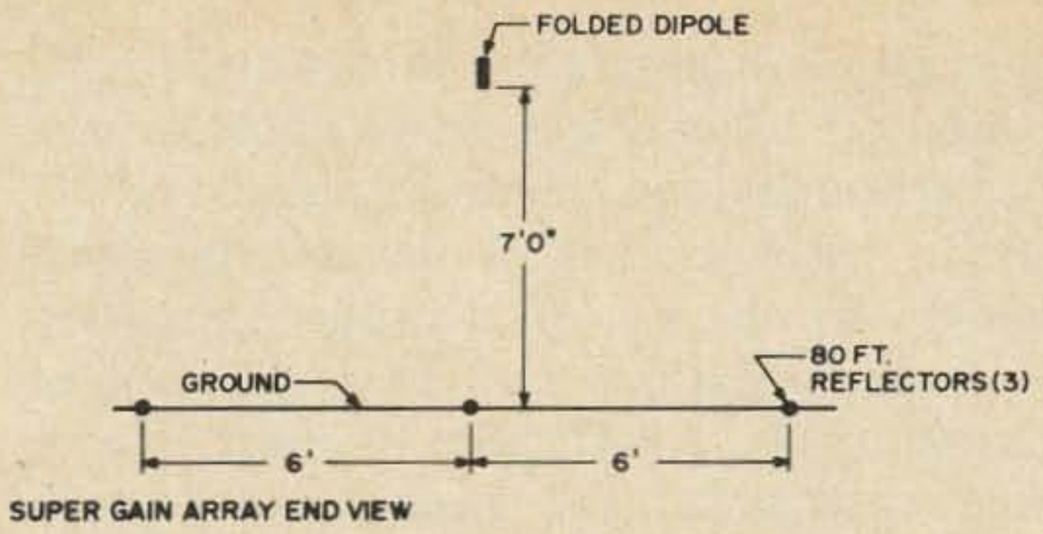

Fig. 2. Super gain array end view.

were 6 DB stronger on the high antenna than on the super gain array. The rejection drop to 6 DB from 700 mile distant stations was due to the loss of gain in the collinear at the 25° arrival angle and not due to improved pickup on the super gain array at the lower angles. These data show that the super gain array does in fact discriminate against signals arriving at the lower elevation angles. Comparison checks, made at the same time, on stations transmitting from sites in Florida revealed that signals originating within 80 miles of the super gain array were approximately 15 DB stronger and stations within 200 miles were 10 to 12 DB stronger on the super gain array than on the collinear array at 60 feet altitude. In general, in the daytime a very marked increase in received signal level is apparent on any station within approximately 200 miles of the super gain array, and the most noticeable aspect is that signals that are received on the super gain array are much more free from QRM, whereas on the other antenna noticeable QRM, or even difficult copy, may be present. This is a result of the combination effect of the super gain antenna 9 DB gain plus its 10 to 15 DB rejection capability for low angle QRM. The 15 to 25 DB improvement in signal to QRM is very obvious.

Nighttime performance

In general, the super gain array gives approximately 10 DB rejection against the foreign broadcast stations much of the time but some of the time, due to the nature of the 40 meter band, these long distance signals arrive over many, many hops and come down within the vertical acceptance angle of the super gain array. At these times, there is little significant difference between broadcast interference received on the high collinear or the super gain array, but the

super gain still boosts the transmitted signal greatly. At other times, when short skip is not predominating, there is a marked reduction in QRM as well as increase in signal strength by the use of the super gain array for communications out to a distance of approximately 1,000 miles at night. Under these conditions, the strength for signals originating within 1,000 miles is boosted similar to that experienced over 200 mile daytime paths.

Most persons who have worked with array antennas on the high frequencies are aware of the fact that it is difficult to get a sizeable change in S-meter level between a reference antenna and even moderate sized array. However, the results obtained with the super gain array are striking in that the S-meter moves appreciably, usually at least one and sometimes two S-units in actual signal level, and if the QRM level will be noticed in the quiet periods of the transmitting station, it will be found to drop from 3 to 5 S-units when using the super gain array. If the QRM is of low angle origin, our experience has been that this antenna frequently changes a QSO from barely readable to armchair quality.

Due to the extreme simplicity of this antenna and to its significant improvement in communications on this particular band, plus its small size, I believe that if amateurs erect such an antenna and test it for themselves, they will be quick to see the value of it and by this means more use can be obtained from the 40 meter band. Particularly, this antenna would be an ideal antenna for local nets or statewide nets operating in the 40 meter band in the daytime, since it not only greatly increases the signal strength of the stations communicating, but significantly reduces the QRM leaving the state and rejects any QRM coming in from outside the state.

For those amateurs wishing to study further on the subject of super gain antennas and the types of gain that may be obtained, perhaps the most understandable and clearly-written dissertation is to be found in "Electronic and Radio Engineering" by Terman, fourth edition. Discussions on pages 903 through 908 cover the subject briefly and references are given there no more theoretical work should one desire to dig deeper.

Many amateurs have from time to time used very low dipole antennas on the 40 and 80 meter bands and some have remarked that these antennas do not perform as poorly as they would expect based on the low height. These results, however, have been erratic because the effect achieved is greatly dependent upon the conductivity of the ground under the antenna, and no compensation was made for the drastic change in radiation resistance or the change in effective length for such low antennas. The directivity gain of the very low antenna, which can be up to eight times in signal power, is frequently attained, in part, in these low installations over moderately conducting ground. However, the counteracting loss in antenna efficiency suffered, unless a reflecting screen is placed under the antenna to control the enormous losses in the ground, the variable reflection distance and low radiation resistance make the overall results highly variable from one installation to another.

The use of the reflecting screen is very important for three reasons. First, the antenna impedance will be 50 ohms only when the elements are cut as described above with reflecting elements installed. Without the reflecting elements this impedance can vary significantly. Secondly, the efficiency of drop well below 50 percent in most installations without this reflecting screen. This means that the overall gain of the antenna may be anywhere from zero gain, or perhaps even a loss, to a full 9 DB gain, depending upon the peculiarities of the soil under the antenna. Thirdly, without the screen the spacing between antenna and image is unknown and unstable, varying with ground conditions. Due to the utter simplicity of the reflecting screen, it is not worth the risk to omit it. Also, the effective length of the antenna varies with ground conductivity without the screen, so design becomes a cut and try affair.

It is hoped that other amateurs will erect similar antennas and run comparative tests on 40 meters as well as 80 meters and 160 meters. The 80 meter band performance of the super gain array has not been explored

yet so that the relative percentage of the time during which short skip conditions prevail, and therefore the magnitude of improvement possible, is unknown to me at this time, but will be published as soon as my tests are completed. However, those wishing to try such an antenna on 80 meters or 160 meters may scale the dimensions given, which is centered on 7250 khz, to obtain the design numbers. For those with lots of room, a group of these units operating broadside could generate a formidable signal indeed, but more than about four units would begin to restrict coverage noticeably. . . . W4NVK

[1]Patent disclosure filed.

[2]a. "Maximum Directivity of an Antenna," H. J. Riblet, Proc. IRE, 36 p 620, May, 1948.
b. T. T. Taylor, Proc. IRE, 26 p 1135, September, 1948.
c. "Physical Limitations of Directive Systems," L. J. Chu, J. Apl. Phys., 19 p 1163, December, 1948
d. "Directional Antennas," G. H. Brown, Proc. IRE, 25 p 122, January, 1937.

[3]This figure is referenced to a dipole, all others in this article are referenced to isotropic.

[4]Reference to dipole.

Printed Circuit Soldering Aid

Fixing printed circuits is really quite simple. Just clip out the defective component, leaving as much lead on the board as possible, and solder the new component to the old leads. This method works, and is recommended by many authorities. It does look like a butcher job though, doesn't it? A much better way which doesn't take much more time, considering the time spent locating the defective component, is to take it out completely. Usually the holes, whether printed through or eyelets, are plugged up with the old solder. Let it cool off; then quickly reheat and clean the holes with a piece of piano wire or stainless steel wire about .050 inch diameter. Solder will not stick to it, yet it can be formed and filed to a sharp edge at one end to aid in cleaning out the fringes of solder. A bit of masking tape makes a convenient handle if wrapped around the center portion of the tool.

Roy A. McCarthy, K6EAW

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DX Corner

A number of letters have come in from WTW Certificate holders asking me to correct errors in the standings list published in March. While there isn't a lot that we can do about the list already published, every effort will be made to see that future boo-boos are kept to a minimum. Bear with me and I am sure that it will all be straightened out.

The cards that have been coming in show that 20 meters is still the favorite DX band. But there are signs of increased activity on the other bands. In the last few weeks I've been pleased to see that cards have been submitted for awards on two and even three bands. I realize that many of you are chasing that elusive 300 mark on 20, but you should do a bit of listening on others. The results may prove gratifying. You will find that a great many DX stations will be eager to make schedules for the other bands as well, for they are also interested in contacts on more than one band.

We have gotten used to thinking of DX in terms of 15-20 meters, principally. A common complaint goes something like this, "I listened for a couple of hours on 10 meters the other night and the band was completely dead. There's nothing doing there."

I'd like to suggest that you aim your antenna over the pole, about 345 degrees here in the East, and call CQ DX Pacific a few times. I don't want to make any rash predictions, but don't be surprised if you get answers from VR, JA, DU, XW8, VS6 and the like. It seems that a lot of people are listening at the same time without calling. So nobody answers!

I'd also like to encourage you to spend more time on 75-80 meters. There have been some very good openings lately, and wouldn't it be nice to hang a certificate on the wall for this band? How about it? In line with this I'd like to suggest that if you have not gotten your copy of the 73 DX Handbook, you do so at your earliest convenience. Concerning my mention of 80 meters, there is a tremendous article in the Handbook on just this subject by John Devoldere ON4UN. It is complete in every detail. John really went all out on this one. I am confident that anyone who reads and absorbs it will acquire valuable information that will assist in garnering many DX contacts on this band.

So I hope you will order this very important book soon. If you are interested in DX, I can assure you that it is the smartest three bucks you could spend, and worth many times the price.

I've been thinking—there are quite a few persons on the air who express anti-DX sentiments which often go unchallenged. There seems to be an idea going around that DX fever is an indication that somehow a ham is not a gentleman. It is a bit reminiscent of the attitude of some of my dry fly, purist angler friends toward bait fishermen.

This, of course, is arrant nonsense. My only reason for bringing it up at all is that I'd like some of these DX haters to try it for themselves, just once. Let them get into the competition for a piece of rare DX, overcoming their prejudice for just that brief recess, for just a taste of it. I'll warrant that a majority of them will be forced to concede that they've had the time of their lives.

It's hard to admit one basic truth. All types of operation may flourish and flower without adversely affecting the organic well-being of ham radio as a whole. There are some who express fear for the hobby's future unless everyone throws out his commercially built gear and builds his own. Silly, isn't it? Traffic men despise ragchewers. CW operators have contempt for phone men and vice versa. QRP enthusiasts loathe high powered boys. AM'ers call SSB'ers names,

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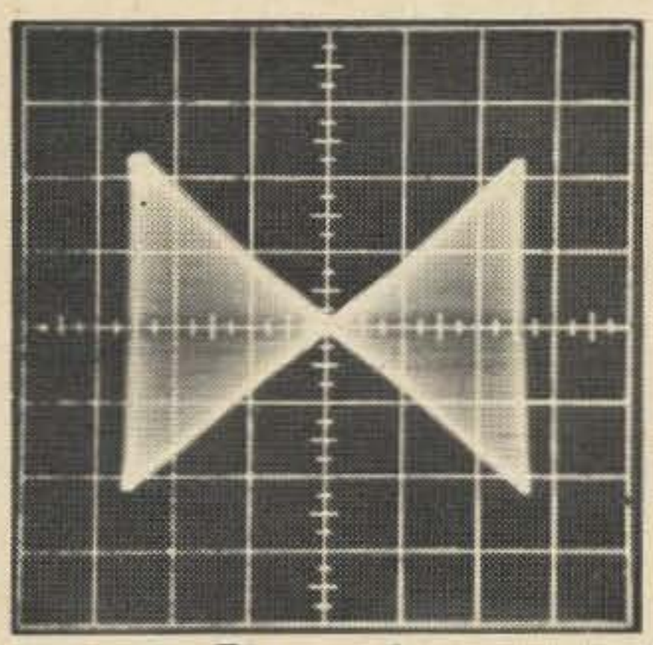

Figure A

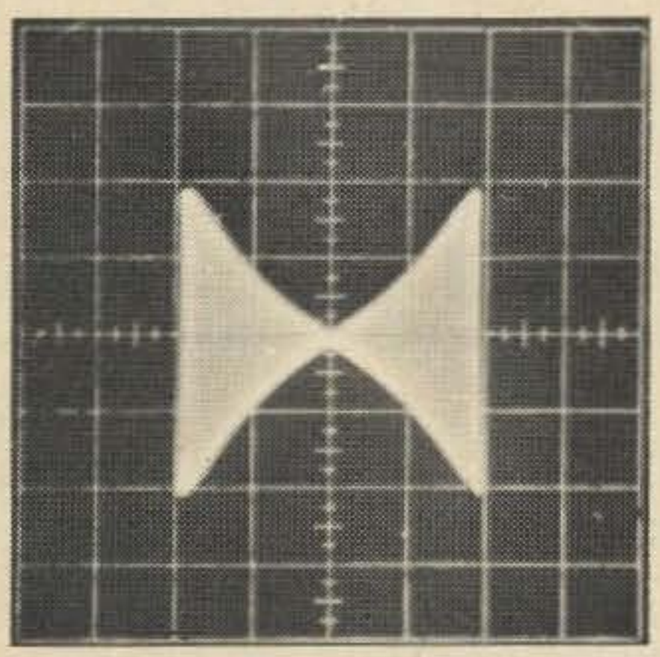

Figure B

All amplifiers for SSB operation are called linear amplifiers. Frankly most of them are "so-called" linear. One amplifier, the 2K-3, stands out as a linear linear. You've heard the clean, sharp signals on the air. They shout "LINEAR LINEAR".
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and low band ops wouldn't spit on VHF'ers. And so it goes. The fact is, we all need each other, for the very life blood of ham radio is its broad diversification. We need all types of operations on all our frequencies.

Since DX occupies the hearts and minds of a large segment of our ham population, I believe it's wrong for non-enthusiasts to express violent opprobrium on the air, as though they were talking about lepers.

Many of our critics became sour on DX because they were not successful at it. They probably discovered that it was not as easy as they thought. Successful DX'ing is one of the most demanding facets of the game, calling for skill and patience, coupled with experience and maturity. It is not unusual to chase a specific country for years, and even then, there is no guarantee of getting it. I have been after a few of them for a long time, and I scrutinize the bands for them almost every time I sit down to operate. This is the only way I know; there is no royal road to success.

Many stations not engaged in DX chasing are operated in a fashion that would make the average DX'er cringe. They use mediocre antenna systems which simply could not cut the mustard. Their procedures would not begin to serve in DX'ing, for they still do not comprehend the importance of listening, listening, and listening some more. They are far too busy saying their "By Golly" and "Fine Business" for that.

But this is only one man's opinion. Don't take my word for it. If you want to get a taste of real excitement, put your signal and skill on the line, and get into one of the pile-ups sometime. You may become frustrated, that's for sure. But you will also find yourself developing a healthy respect for the skill and ability of the successful ones.

We all recall the story of the completely outfitted fisherman, with all the fancy tackle, encountering the kid with the buggy whip, dime store hook and can of worms. The urchin has no fancy flies, no two hundred buck rod, no waders, no nothing. But he has a stringer full of fish, and the fancy dude with the high class equipment hasn't a single trout. All the kid has is plain old talent, that's all! There's a lesson there for the would-be DX'ers.

Well, that's all I intend to say on the subject. If you are against DX'dom, and you have a feeling of superiority over the fools who participate in it, why, you go right ahead and do your rag-chewing or whatever. It will be your loss, I know.

* * * * *

I worked an odd one the other evening on 14 mhz CW. There was a huge pile-up on the low end calling LG5LG. He claimed to be operating from the Independent Territory of Morokulien, on the Norwegian-Swedish frontier. He gave his QSL address as LA4YF, and asked for three IRC's. Well, though I have a very suspicious nature, I have a standard procedure for cases that seem phoney. I work 'em first and ask questions afterward. So, I got the contact, hurdling the first obstacle.

I must admit to curiosity, so I began to investigate Morokulien. I consulted four of the best atlases ever printed, and there wasn't a trace of the place in any of them. By this time I was pretty certain it had been a counterfeit call, used by some joker, trying to have some fun and excitement for himself.

Later that night, however, I hooked up with a Swedish ham who told me that there really is such a place, and that LG5LG is a legitimate operation. He further informed me that the IRC's are redeemed, and the funds are turned over to a crippled children's hospital and therapy center. Needless to say, I sent my QSL out the next morning.

Both the SM and I agreed that it would be extremely unlikely that this LG5 would count for a new country, but today, when national boundaries and political status is in a constant state of flux, you can never tell. Incidentally, he also said that operations from Morokulien are very, very rare, so there is not likely to be another operation there in a long while. So, if you hear him, don't turn up your nose. Get the contact, just in case. What have you got to lose?

Gus has been making all sorts of stops in the Indian Ocean area, but so far there's been nothing that would add to anybody's totals, either for WTW or DXCC. It's pleasant to work Gus anyway, of course, but it would sure be nice to hear him from some rare one, Sikkim, Bhutan, Tibet or maybe

BY land. Speaking of rare ones, I'm preparing a questionaire for publication in the near future, which will aid in determining the priority ratings of wanted countries. We will then be in a position to assist DXpeditioners to plan their itineraries. It's not that we spurn a country simply because we already have it in our logs, but all of us are itching to get a shot at some of the more elusive ones, I'm sure. Is there anyone who wouldn't jump at the chance to work a ZA, YI, FO8 Clipperton, etc.? The questionaire will appear in a few months, and when you get your 73, don't forget to fill the thing out and send it in, so we can tabulate some meaningful country priorities.

The 1N2A that showed up on 20 Meters a short time ago has to be a phoney. The prefix is not assigned by ITU, and the Marco Island he purported to operate from is not listed in any of the four major atlases which I consulted. I cannot find any island in the area of coastal Peru which might be the one, for all those shown have well established names. Oddly enough, the signals peaked at approximately the right beam heading. My best guess is that someone was operating someplace in Ecuador, Peru or Chile.

I heard another lulu the other morning, claiming to be in Basra, Iraq. He was using G3NOF/YI and called himself Mike. The only catch is, G3NOF is Don McLean, a very good friend of mine in Yeovill, who's more interested in jazz recordings than in traveling for an oil company, which this joker claimed to be doing.

I simply can't understand the type of mentality which goes to the trouble of engineering a DX hoax. It's a lot of hard work; almost drudgery. And . . . for what? I think that most of these guys must suffer from vacant apartments in the upper storys.

Here's something that's bothered me for a long time. You hook up with a German, Czech or Russian. He speaks the English language with an accent, that's for sure. But, have you ever noticed, as I have, that his grammar is perfect in most instances. Syntax, number, gender and case are used properly. He never says who when he means whom. He doesn't mix up imply and infer. He doesn't split infinitives either. Yet, American amateurs, born and reared in this country, sometimes speak the most horrendously poor English to be heard anywhere. It is downright humiliating to hear some of the lingo that passes for English. As my friend W2NDK, Arthur Harris, says, "He don't speak so very many, but he doing the best what he are!"

I heard a couple of lads on 20 the other night who were having a time for themselves. They kept reducing power to see how long the copy would hold up. The fellow in Australia was audible here in New Jersey when he was reporting a dc input of 500 miliwatts. I lost the Ohio station at about 75 watts, but the VK continued to read him. It was most interesting. I understood why the VK came through so well when he described his antenna. He was using a wire quad; eleven elements on a 150 foot boom. I can't even visualize an antenna like that. Brother, that's what you call an aerial and a half!

During the course of the last year or so I have been QSL manager for Danny Willis, CT2AS. It is really surprising to see so many hams who are still unaware of the importance of getting the date correct, and making sure that the contact is logged in G.M.T. There simply isn't enough time in which to go hunting through hundreds of log entries in order to find one. It's the proverbial needle in the haystack. Please, everybody, get into the habit of using Zulu time.

We have finally gotten the new countries lists for WTW from the printer, and they are ready to be sent out to anyone who requests them. Remember, you will need one for each of the bands you intend to submit for, but they need not be sent in with your cards. You may transcribe the list on ordinary paper, typewritten, if possible, showing the contact and date. So long as this list is legible it will suffice.

Here are the currently claimed WTW scores. Some of you have been inquiring about countries lists. They are in preparation and should be available, soon. All who have requests in for them will receive them as soon as they come off the press.

It looks like we are close to our first WTW-300 certificate. I'd feel a lot better if there were some hot competition for this award. Many of you have evidently been lying "doggo" recently, for I have not been

getting too many revised claimed scores lately. How about pumping up those scores? Frankly, WTW is hurting from a drought of activity. There does not appear to be sufficient interest in the award at present, and the reasons for this may be many and varied. Not the least, I'm sure, is the removal of some of the frequencies formerly enjoyed by all of us. Rather than probe into those reasons, though, let's just say that we hope the inactivity is merely temporary, and that we can look forward to better conditions ahead. I'm pretty sure that if a rare one were to show up there would be a revival of interest. All we need is a Clipperton operation; Tokelaus, Chagos, Agalega, Kuria Muria, or the like, and watch those grounded grid amplifiers start heating up. The Malpelo action recently showed that there's still lots of life among the DX hounds.

The Coast Guard has now revised its former opposition to operations on Navassa. They will now permit ham operations there during the two times a year that a Coast Guard vessel in in the vicinity. This is excellent news, for there are many who have expressed a strong desire to go there. So I think that we can all look forward to another shot at this goodie in the near future.

WTW HONOR ROLL (claimed scores)

7 mhz-CW:

W4BYB	151
W3WJD	100
W8ZCK	100
VE3BLU	105 (new certificate)

14 mhz-CW:

WB6NWW	113
K4CEB	102
W8EVZ	102
W4CRW	101
WA2DIG	100
K8IKB	100
WB6SHL	100
W9HFB	100
W5ODJ	100
WB2TKO	100
WA9KQS	100
W1ETV	100
K5BXG	100
K4ASU	100
WA6GLD	100
W2UGM	100

14 mhz-Phone:

W6YMV	150
K2QOU	125
WB2NSG	122
K4GXO	120
K1SHN	111
W1SEB	110
W4TRG	106
WA4OPW	105
SVØWL	105
WØSFU	104
W3SEJ	103
CN8FC	103
VE3ELA	102
VE6AKV	102
K4VKW	102
W6OHU	101
W8WAH	101
WAØOAI	101

21 mhz-CW:

W4OPM	200
WØDAK	107
WA9NSR	103
WB2UDF	100
VE6TP	100
WA6GLD	100
WØRRS	100
WA9OTH	100

21 mhz-Phone:

W4OPM	220
WA5LOB	162
W6MEM	161
WA2FQG	155
WA1EUV	138
WA5DAJ	130
W9NNC	125
WB2RLK	110
W8WRP	106
W4SYL	106
W2PV	104
W1EED	103
K5HYB	101
W2VBJ	101
K4VKW	101
WB2OBO	101
K9PPX	100
W6YMV	100
WA4WTG	100
WAØOAI	100
WA8VFK	100

28 mhz-Phone:

WA5LOB	150
W6MEM	129
WA5DAJ	117
WB2RLK	115
W2PV	106
W2VBJ	104
WA7BPS	102
W4GJO	100
W5YPX	100

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and I wish some clubs and groups would volunteer to complete our list. Meanwhile if your area is not covered, send cards directly here, at: 1 Daniel Lane, Kinnelon, NJ 07405, along with $1.00 to cover handling and cost of certificate, etc. If you wish your cards to be returned via registered mail, etc., be sure to enclose enough money to cover same, otherwise they will be returned at the cheapest rate; hardly the safest method.

1st District None (send cards here)

2nd District Peninsula Amateur Radio Club
Foot of 25th St., Veterans Park
Bayonne, NJ 07002

3rd District Western Pennsylvania DX Society
John F. Wojtkiewicz W3GJY
1400 Chaplin St.
Conway, PA 15027

4th District None (send cards here)

5th District Garland Amateur Radio Club
2905 Sheridan Drive
Garland, TX 75040

6th District Orange County DX Club
James N. Chavarria
3311 Stearns Drive
Orange, CA 92666

7th District Western Washington DX Club
William H. Bennett W7PHO
18549 Normandy Terrace S.W.
Seattle, WA 98166

8th District Straits Area Amateur Radio Club
William Moss WA8AXF
307 Grove Street
Petoskey, MI 49770

9th District Montgomery County Amateur Radio Club
Scott Millick K9PPX
Litchfield, IL 62056

10th District None (send cards here)

Canada (all) Edmonton DX Club
VE6GX, 12907 136th Ave.
Edmonton, Alberta, Canada

Oceania New Zealand Assn. of Radio Transmitters
Jock White ZL2GX
152 Lytton Road
Gisborne, New Zealand

South America Venezuela Amateur Radio Club
PO Box 2285, Attention YV5CHO
Caracas, Venezuela

As you can see, we are badly in need of additions to this list in Europe, Africa, South America and Asia. We could also do with one in Australia. Interested groups and clubs please contact me via 73 magazine or direct.

I take particular pleasure in announcing a welcome addition to our award. The Committee has agreed that we should establish two new categories. Here is the rundown.

MWTW, Mobile Worked the World, is awarded to mobile stations exclusively. The one band-one mode rule is bypassed for this category. All bands—all modes will count toward the certificate. The only stipulation is that any contact must be made with a mobile antenna. We will not honor any QSO known to have been made where a mobile rig was piped into a fixed station aerial, as is sometimes done on vacation trips.

WTWM, Worked the World Mobile, is awarded to fixed stations for contacts with mobiles, including maritime and aeronautical. In this category we will retain the one band-one mode rule. All other WTW rules will continue to apply, with respect to date of contact, etc.

After some thought, it has been decided that cards which may already have been submitted and counted toward an existing certificate, may be applied to the new MWTW award. If you decide to go for this certificate, you may re-submit any of them which might be eligible for inclusion. But, please make sure to note that they are re-submissions so that we have a record in your file.

We don't have the new certificates printed for these awards as yet, but you may submit the cards now. We will process them now and notify you at once, sending the certificates as soon as we get them. Please send your entries to me, direct, as the check points have not yet been notified of the new awards. Good luck to all participants.

We will not issue new certificates for credits above 200. Instead, we have designed an endorsement sticker, which is to be affixed to the original award. Any applicant for WTW-100 or WTW-200 will receive the certificate, and when he applies for 300 he will be awarded the endorsement.

This will save us a great deal of trouble and expense, and it will save you the cost of an additional display frame. Also, it will enable us to send you back your QSL cards plus the sticker in one mailing rather than

two. It will also do away with the problem of mailing tubes, which, I swear to you, is the biggest pain-in-the-posterior I have ever encountered. You cannot buy less than a gross of the bloody things, and when you do get them you have to find adequate space to put them. And, they collect more dust than you could imagine, but worse than that, they seem to be a natural habitat for honey-mooning field mice, wasps, spiders, carpenter ants and other unattractive varmits of varying descriptions.

There may be a few recently issued certificates whose holders are not listed this time. They will be included in the next publication of the list.

Next time we hope to have a report from Gus. Also may have some interesting disclosures from a well known former DXpeditioner who will tell all about some of his past corner cutting. This promises to open up a whole can of beans, and is guaranteed to turn a few faces red.

Next issue will include updated claimed scores, new certificates issued and order of standings. Don't forget about the new MWTW and WTWM. I'd like to see lots of applications in the mailbox. That's it for now. See you next month.

. . . K2AGZ

Try This One

Try this one on your friends and see how many will take the bait without giving it a second thought. The problem is: Your monitor scope has gone sour. The trace is very faint with the intensity control at maximum. You have checked the schematic and decided to measure the divider. According to the manual this point should be at -560 vdc in respect to the chassis. If you want to impose the least possible load on the circuit, do you use the 1000 volt range on your 20,000 ohm per volt VOM or on your VTVM, with its 11 meg input?

If you said the VTVM go directly to jail, do not pass go, do not collect $200. The correct answer is the VOM. The VOM on the 1000 volt rangex 20,000Ω=20 megohms, or nearly double the input resistance of the VTVM and for this reason would load the circuit only ½ as much.

. . . . **Bill Turner WAØABI**

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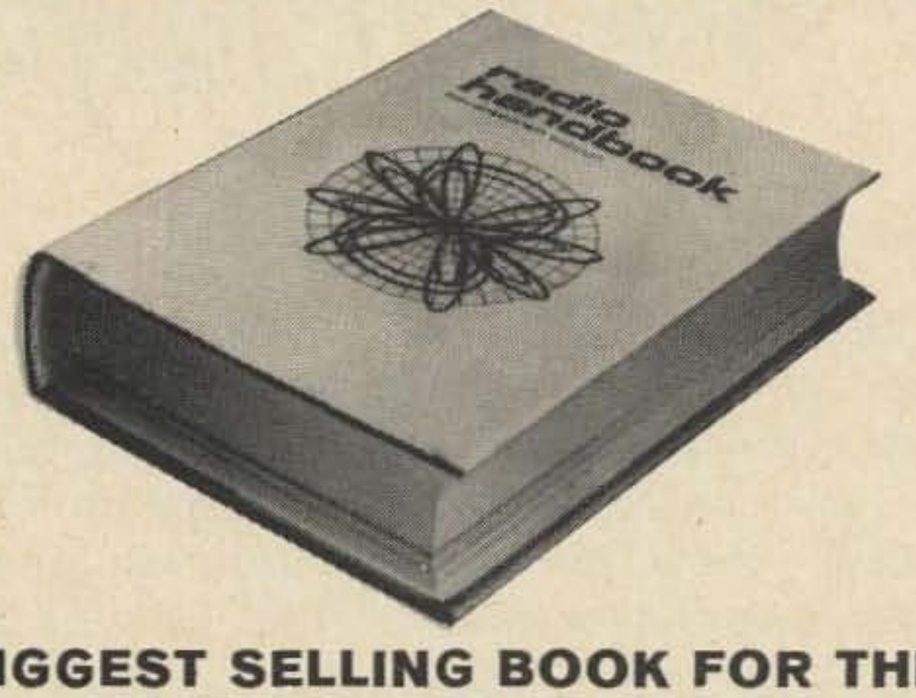

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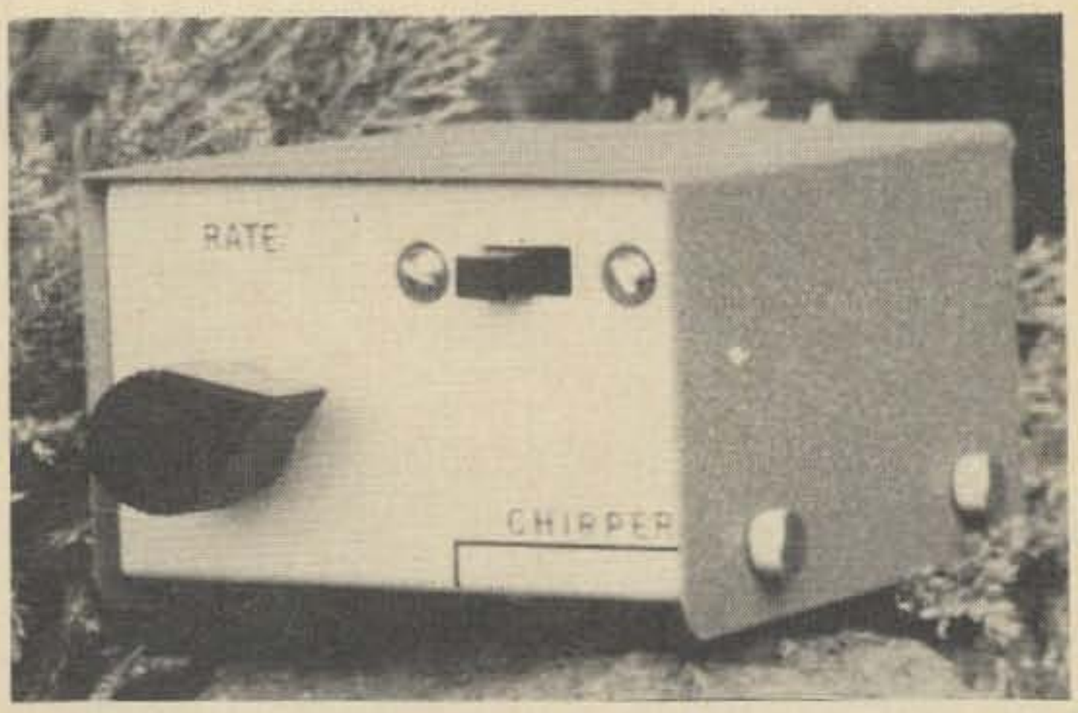
FET Chirper

The Chirper is an automatically keyed, crystal controlled, signal source which may be used to optimize the signal-to-noise ratio of a receiving converter. Homebrew or commercial, converters are a common thing around an amateur station. And, most of the VHF Tribe have read thru a jungle of esoterica dealing with low noise front ends, the velvet beauty of FET's on Two, noise generators and eternal truth, and how to copy 20 db below the noise by the selective use of liquid helium. With a kind of relentless evolution converters have been getting better and better, noise figures become lower, and the prices of suitable front end devices are dropping by the hour. But when it comes to aligning these converters the scene is one of wretchedness. A black art at best, the job is taken up with an enduring combination of blunt instrument and myth. The latter have a certain charm. Are you convinced your converter is in top notch condition because you can "hear noise" when you attach the antenna – or better yet, when you place a 50 ohm resistor across the input? Try putting a complete short across that same input. Shorts aren't much good as noise sources. You'll find the short gives about the same change in noise level as the 50 ohm termination. What has changed is the impedance the front end "sees". The same is partially true of the noise from the antenna. Neither is indicative of the performance of the converter. Peaking the system up for maximum on either a weak signal or on noise gets you nowhere. The diode noise generator which every VHF book of substance describes is a good and useful tool when used properly. The assumption is that everyone already knows full well how to use it and does so. Few in fact do.

I'm sure you've read of it before in many places, but a little redundancy is in order. The noise with which you are concerned is the noise generated *internally* by the first tube, transistor, or other active device the signal encounters upon its arrival at your converter. By fiddling with the external



reactances, adjusting the voltage and current and otherwise manipulating the things soldered to the device, one may minimize the internally generated noise. At the same time the reason the front end exists is to amplify the signal. One usually desires as much amplification possible, short of smoke and oscillation. Minimum noise and maximum amplification is the game. Though the two are not quite mutually exclusive a certain amount of compromise takes place. Thus, the signal to noise ratio. When aligning a converter's first stage every adjustment effects *both* signal and noise. Given a constant signal source coupled into the converter thru an appropriate impedance, the job is finished when the front end has been adjusted for the greatest *difference* between signal and noise of which it is capable.

The Chirper is designed to help you do all this by letting you see what effect each adjustment has on both signal and noise. The TIS34 oscillates at a frequency controlled by the crystal. With the constants shown, that can be anywhere between 8.2 and 36 MHz. The variable capacitor must be adjusted for resonance. It isn't particularily critical but its setting peaks the *rf* output at either the fundamental or some harmonic. For 6 meters an 8.35 MHz crystal is used. A 9.0 MHz rock will pin the meter when the Chirper is connected into a 2 meter converter. The Amidon[1] toroid is wound with No. 30 enameled, 40 turns for the primary and 5 turns for the secondary. After it is

1. 12033 Otsego St., N. Hollywood, CA 91607

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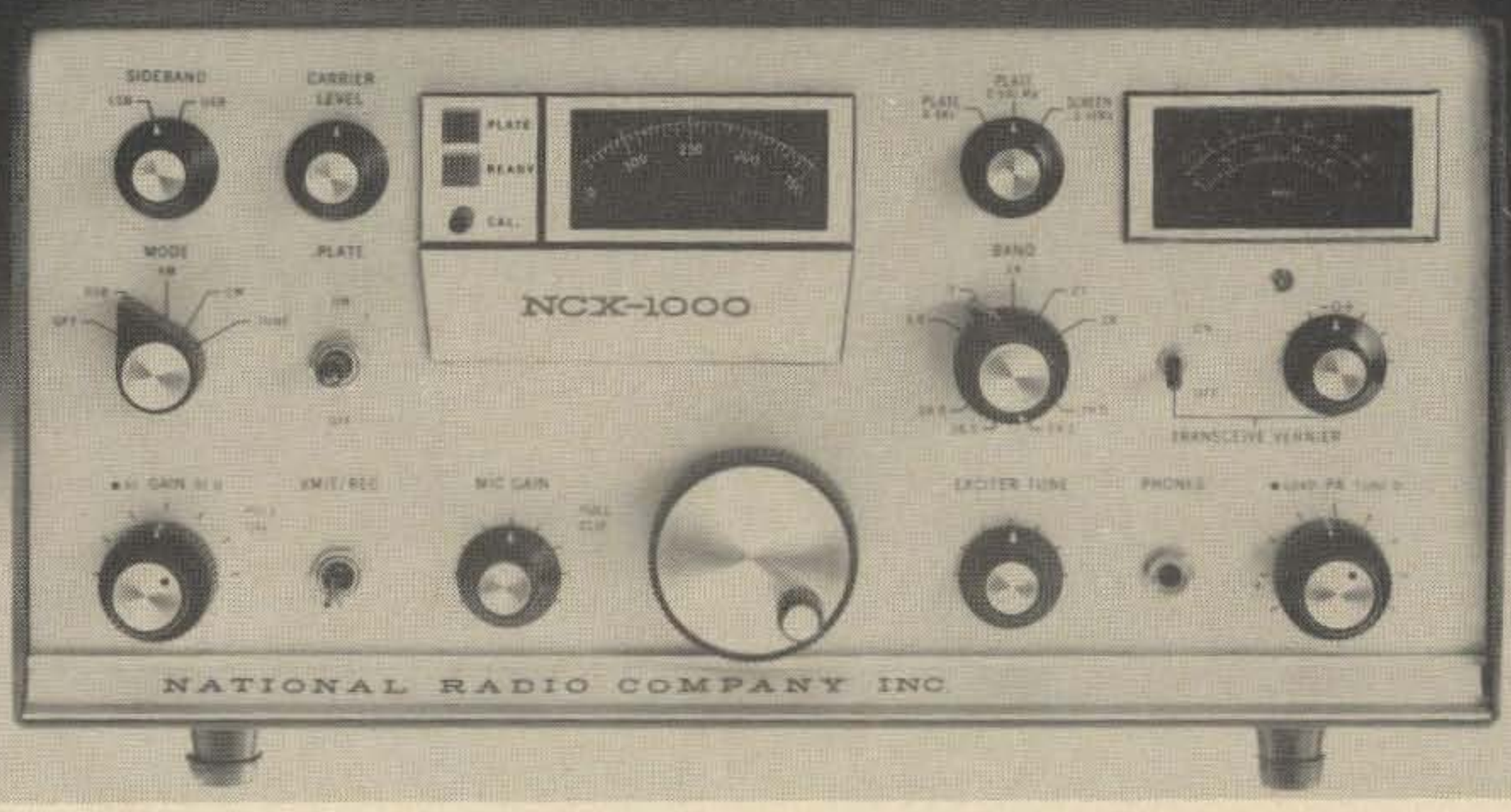

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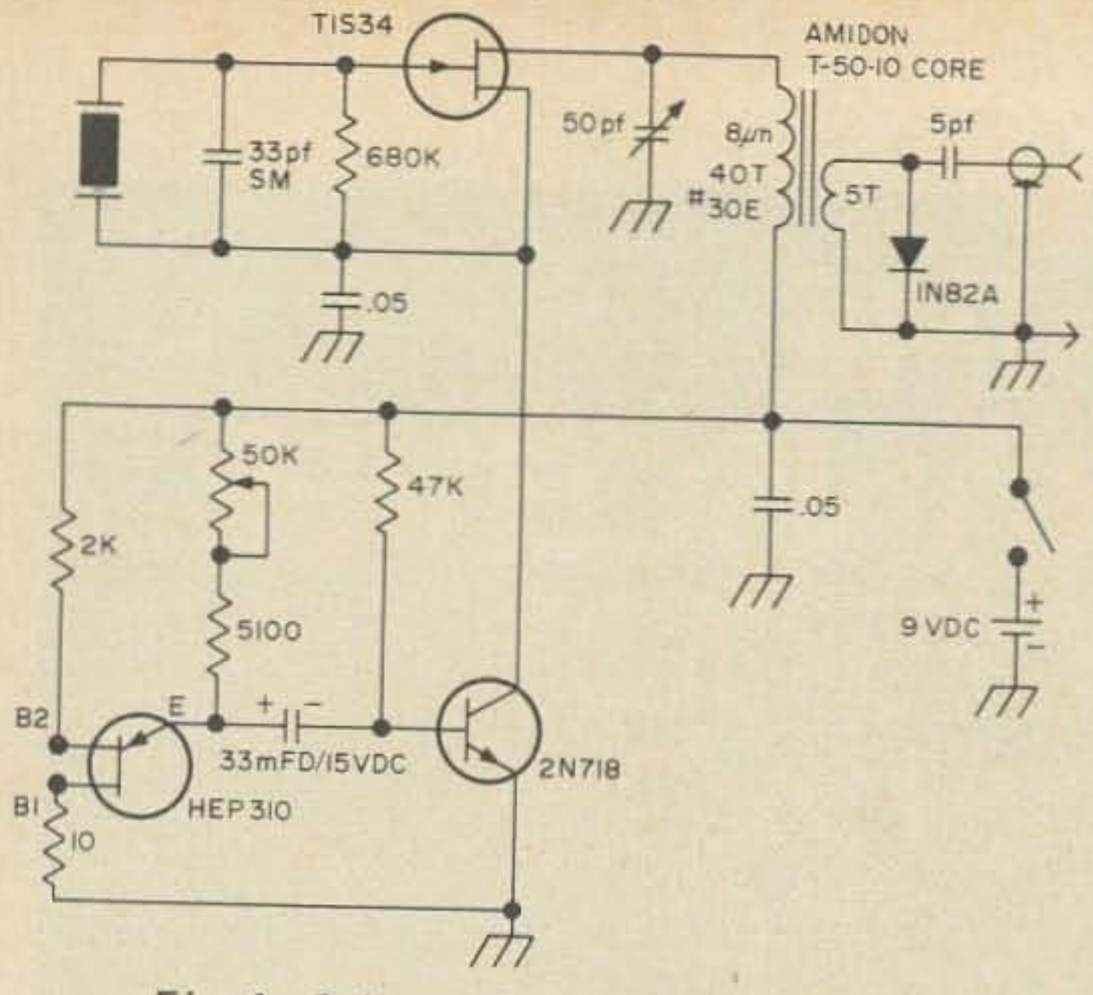


Fig. 1. Schematic of the FET chirper.

wound, spread the turns to fill the toroid and paint it with Q dope. The diode and 5 pF coupling capacitor are connected with the shortest possible leads, the diode being grounded at the *rf* connector. The harmonic output is excellent and quite useable at 1200 Mhz.

The oscillator is turned on and off by a multivibrator combination of unijunction and NPN transistor adapted from the *G. E. Transistor Manual.* The rate at which the multivibrator cycles is determined by the large value capacitor, in this case 33 mF. The polarity of the capacitor is critical. Observe it. To increase the cycling rate, decrease the capacitance; and, to decrease the rate, put in a larger value. Mine cycles a little under once per second. A value somewhere between 30 and 40 mF should suit your needs. You are better off scrounging some odd value from a defunct computer board because of the tolerance problem. If it says 33.2 mF, its probably pretty close to that value. Otherwise you're dealing with tolerances of plus 100% and minus 50% or something equally grotesque. The 50K pot determines the portion of the cycle during which the oscillator is On and is mislabeled rate on the Chirper shown. The HEP-310 is generally available and inexpensive. Other unijunctions were not tried. On the other hand almost any NPN of reasonable quality will work in place of the 2N718. A number of 2N388 and 2N3478's were tried and behaved well. It's a good place to use those transistors you've replaced with FET's. Use something with a Beta of 50 or better for best results. The 5100 ohm resistor in series with the pot is for current limiting. It's deletion will increase battery drain with no increase in Chirper performance. Normal current from the 9 volt battery is around 5 mA.

Construction is non-critical and pretty much a matter of taste. Mine is built on a piece of vector-board and mounted in a Suzurando[2] box, model M-1N. It measures 3¼ X 2 X 4" and there is still room inside for additions. It sells for 330 yen, about 92c. A slide switch is used to turn the power on and off. Paint one well of the slide switch with red paint – Testor's Pla, a model plastic paint, is good – and the switch will indicate its position. Red for On and black for Off. It saves batteries. Check your work and the polarity of the large capacitor. Re-check the connections to all the semi-conductors. With four different kinds of devices things can become confused. Set the pot to the middle of its range. Insert a crystal in the socket. Connect the Chirper to your converter, turn the switch on and adjust the variable capacitor for the highest reading on your S-meter. The oscillator will turn on and off. Varying the pot will extend or diminish the amount of time the oscillator is on. Whatever you do, *don't connect the chirper to an external antenna.* The harmonic content is high and even at this power level is sufficient to cause severe interference to television receivers within a two block radius.

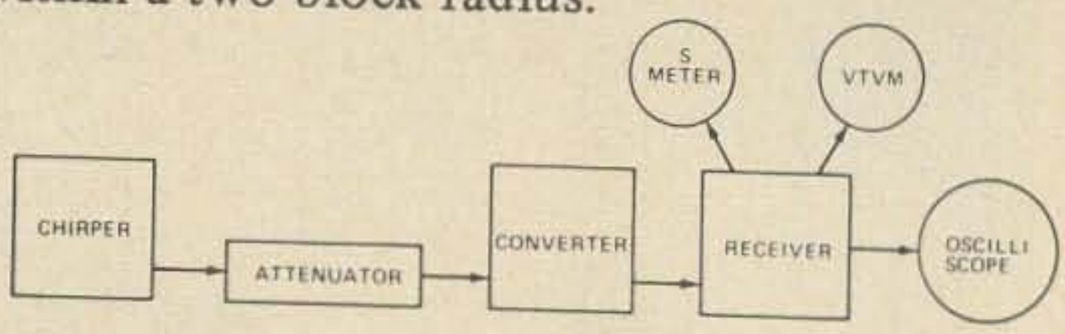
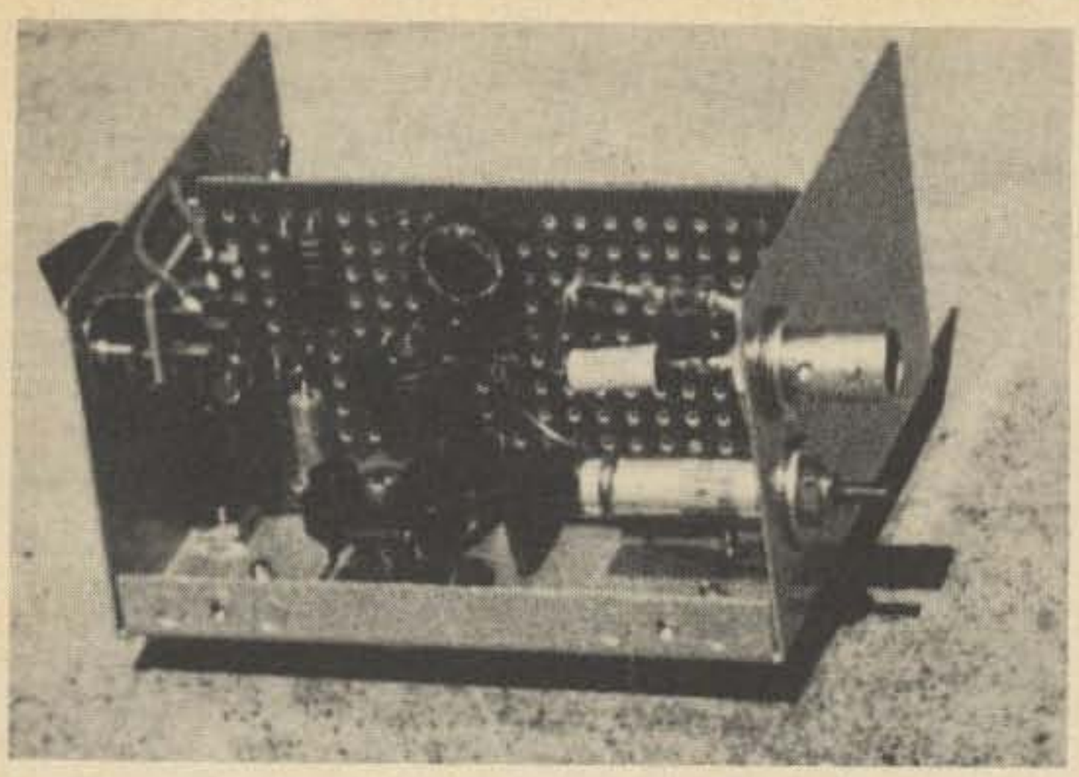


Fig. 2. Test set-up for converter alignment.

For converter alignment, the test set-up is illustrated in Fig. 2. The Chirper is fed to the converter thru an attenuator for two reasons. First, the power output of the Chirper is too high on six and two. You don't want to align with a forty over nine signal. Something around S-5 to S-7 is desired. Second, the attenuator maintains a 50 ohm termination for the converter. A converter cannot be aligned with a floating input impedance. Fixed and variable attenuators of excellent quality are available thru surplus and homebrew data is available. See *73,* January 67, p. 40 for one that will do the job. Turn the receiver avc off. The read-out options are diverse. The best is probably a scope connected to the *if.* A vtvm can be used, connected to the audio output. And, the S-meter can be used with the avc on *fast.* This will vary with the

2. Suzurando, 1-10-11 Sotokanda Chiyodaku, Tokyo



receiver and it's particular time constants. What needs to be avoided is avc pumping that interferes with your readings.

Turn the Chirper on, adjust the attenuator for a convenient signal level. When the oscillator is on, you're reading signal. When the oscillator is off, you're reading noise (on the scope, vtvm, S-meter, etc.). As you make adjustments on your converter, observe the effect on both signal and noise. Adjust for the greatest difference between the two. Turn the Chirper off and re-check the converter neutralization. If necessary, re-neutralize the converter and go thru the whole thing again. Talking about it makes it seem somewhat complex. It really isn't and the whole business won't take long once you've done it. It will become quickly apparent that highest signal level and lowest noise level do not coincide. You can vary the bias, voltage, etc., and observe the effects of each on the signal-to-noise relationship. You can, in short, optimize your converter's performance.

A number of things can be done with the Chirper. There is room in the box to build another oscillator section connected to the transistor collector, operating in parallel and simultaneous with the first oscillator. By appropriate choice of crystal and attenuation, both signals can be introduced into the converter in order to adjust the mixer for minimum cross modulation.

Or, instead of using an oscillator at all, you can use the switching section of the Chirper to key a noise generator on and off. This has a certain attraction where an integrating network is used prior to a vtvm. In this case noise is used as a signal.

In spite of it's name, the Chirper is remarkably stable. Chirp becomes apparent from two meters or so, but is no problem. Build one and take the myths out of your converter.

. . . K6QKL

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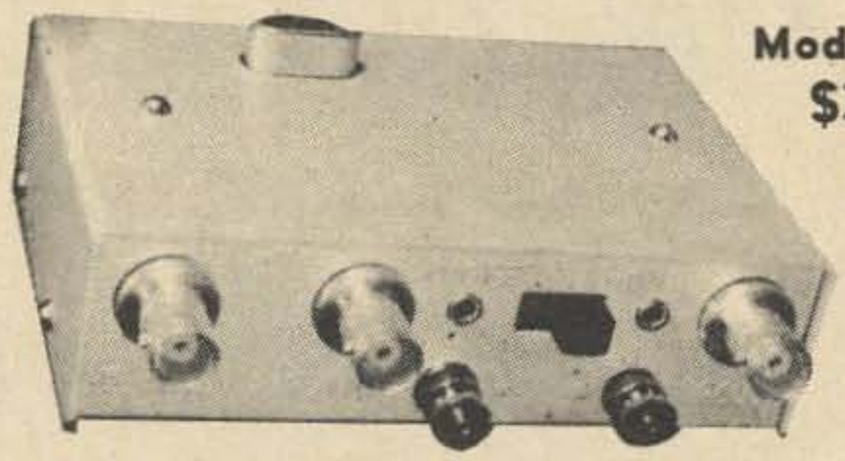

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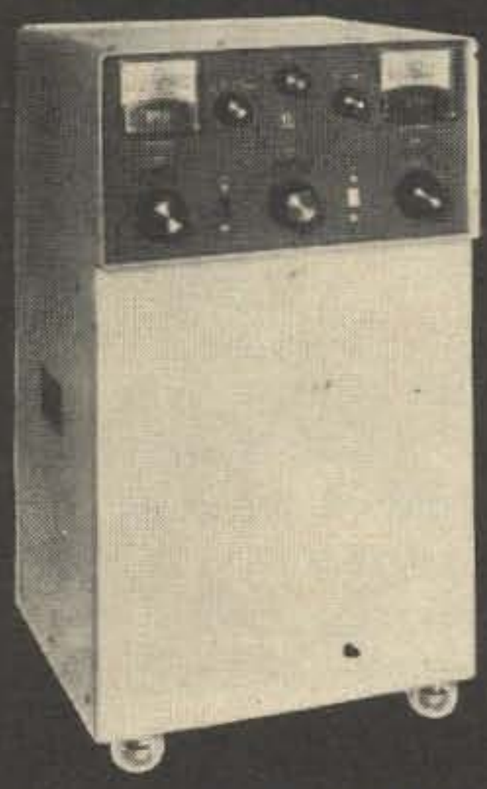

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The Inside Info on Alexander Graham

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As long as there have been radio amateurs, hams have been interested in the telephone system and sought ways to integrate it into ham communications. The worth of this idea needs no explaining. With their great tradition of public service and emergency work, ham operators have time and again proven their skill and efficiency in time of need. Nonetheless, in order to be a truly effective service, ham radio should be ready, whenever necessary, to utilize any and all media for communications. In spite of the fact that the two services grew up together, comparatively little data of any value is available for our use. Therefore the ham is often inclined to experiment on his own. This clandestine activity can have tragic results in the form of angry telephone officials, and, in some cases, can produce real damage to the telephone system, to say nothing of the expensive ham equipment.

In all fairness to the telephone people, it should be pointed out that a service so widespread as theirs can become nightmarishly complex. Take the telephone found in the average home. It's a lot more intricate than the cheap field phones they used to sell in the Radio Shack.

The diagram is the result of the dissection of a surplus telephone, rather than any revelation by Mr. Bell. With the receiver hung up, S4 and S5 are held open. A strong ac signal can pass through C2 and ring the bell, but the rest of the instrument is disconnected. When you pick up the phone, S4 and S5 close. As you start to dial, S1 opens disconnecting the earphone, and S2 closes. As the dial returns, S3 opens and closes pulsing the line. You can follow the circuit from the red lead through S2, which remains closed until the dial reaches its rest position, then through the pulser, S3, through S5 (closed because the receiver is up) and out via the green lead. A dc voltage is present on the line, and the closing of S3 shorts it out, producing pulses which are sensed by the stepping relays at the central office.

After you have finished dialing, S1 and S3 are closed, and S2 is open. The dc voltage now reaches the mike from the green lead, through S5 and S3, through the mike, then into the autotransformer, L, where it is stepped up and sent out over the line. The

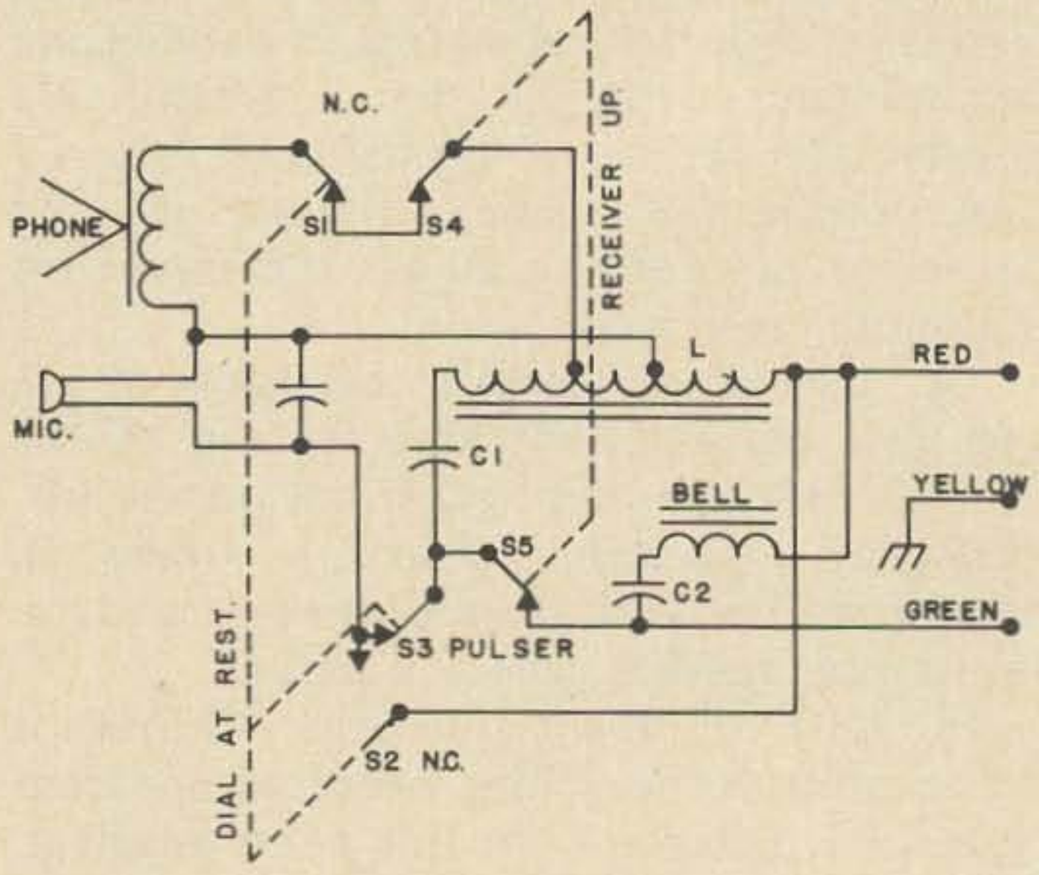

Fig. 1. Diagram of a run-of-the-mill Bell telephone.

capacitor, C1 blocks dc from the auto-transformer.

The dc voltage on the line is in the order of 48 volts when it leaves the exchange, but can be considerably reduced by the time it reaches the subscriber. Sufficient tolerance is built into the system to allow a wide variation. The signal which rings the bell is a 20 hz. The voltage of the ac is 48 volts, but since it is superimposed on the dc, it can sum up to a total of 96 v. The dial tone varies from exchange to exchange. Anything that will make a sound will do.

A line from the exchange to the subscriber is called a loop. The overall impedance can range from 900 ohms to about 1.5 k., although they like to shoot for a happy medium of 1.2 k. Since the subscriber's telephone is midway around the loop, it looks into an impedance of around 600 ohms, and this value is the standard value used by radio stations in a remote broadcast loop. The frequency bandpass for conversational subscribers is 300 to 3khz. This has proven most effective for transmission of speech with the highest intelligibility. Broadcast loops come in several classes. One has a passband essentially the same as a standard telephone loop. This class is used most often for sports and newscasts. The class of loop used for disc jocky type programs, where some transmission of music is required, passes up to 8 khz., and finally, FM stations occasionally use the most expensive class with a full audio passband. (With very few exceptions, AM broadcast stations have an audio bandwidth limiting at 6 khz.)

Audio levels for the telephone system are centered around a reference (O db) of 1 milliwatt across a 600 ohm load. Broadcast loops generally hold their audio levels at 0 to +6 db. Home subscribers have no engineer to watch a level meter, and so it is difficult to pin down the audio level. Bell system engineers have no way of knowing whether the user will be a love-sick bobby-soxer or an eight-year-old telling grandpa about the fish he just caught. These represent two extremes for audio level. For design purposes, they try to consider the average of all voltage levels over a three-second period at -12 db. Using this figure as a design center, they are at least able to minimize crosstalk between lines.

When the receiver is lifted, and switches S4 and S5 close, a dc path is closed for the 48 volts on the line. The resultant current closes a relay in the central exchange which connects you into an available line to dial, and isolates your phone from incoming calls. As you dial, the pulser, S3, produces a series of brief shorts, so far as your telephone is concerned. At the exchange, however, these "shorts" are seen as a series of current pulses. These pulses go into a device similar to a stepping relay, which counts the pulses and connects your phone to a set of contacts determined by the first digit you dialed. Each set of contacts is connected to a second stepping relay. The relay on the set of contacts corresponding to your first digit is pulsed when you dial the second digit. This connects you to a third stepping relay, and so on until you have dialed the full number. The final position of the last relay is connected to the telephone you are calling. The presence of your signal trying to reach this number closes another relay which sets the ringing mechanism into motion.

The ringing mechanism sends a 48 volt ac pulse into the line you are calling. This pulse passes through the blocking capacitor and rings the bell. When that line is picked up, its current censor closes making the final connection. The ring pulse, by the way, is one of two possible signals, depending on the service you have. Both are based on a 5-second cycle. A "long" ring is on for one third of the time and off two thirds. Some phones ring in a sequence of two short rings, each one sixth of the time with one sixth interval between them, and then pause for one half of the time.

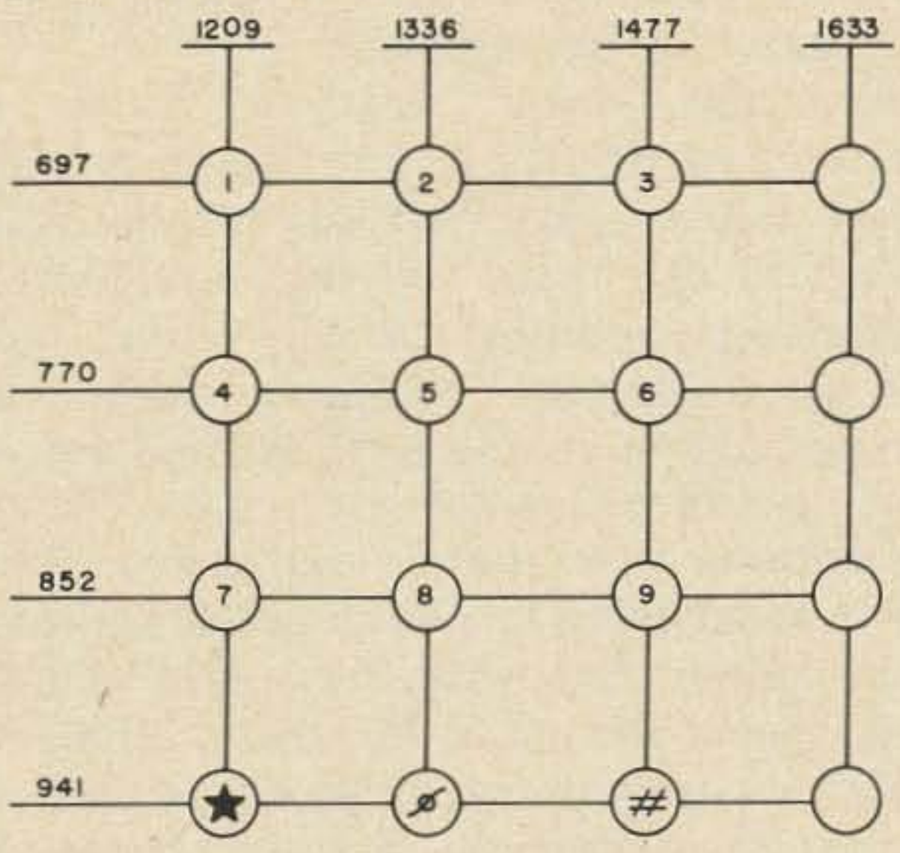

Fig. 2. Touch-tone switching matrix.

The touch-tone system, now available in some localities, sends a combination of two audio tones down the line which trip a frequency sensitive relay. From there the sequence is similar to the dial system except that frequency sensitive relays are used

instead of the stepping relays. The combinations are given in the matrix shown here. The tones for any given digit are determined by the intersection of the tone-lines at which the button is located. For example, the digit, 4, would send out a combination of 770 hz, and 1209 hz. The two figures in the bottom row, # and * are only available on certain military and industrial phones. The 941 hz signal only appears in a standard phone when the zero button is pressed. The fourth vertical row (1633 hz) is not used at present, except in certain data-transmission systems. For the most part, it is reserved for further expansion.

The descriptions given so far are a very simplified version of what goes on when you make a phone call. Multiply this by a theoretical ten million possible number combinations and you can get a slight idea of the nightmarish complexity of the system. One small goof by some character who doesn't quite know what he is doing, reflecting back through the central exchange, can upset the whole applecart. The telephone system, being an emergency service, is therefore protected by federal and state laws against any tampering that might disrupt the service or invade anybody's privacy. As one telephone engineer explained to me, "It's not that we're trying to monopolize the equipment, but unless we know what is hung on that line, we can't do our job. Also, you're paying for the service, not the lines. If you put on an extension phone of your own, you're taking service that you're not paying for."

Over the years, Amateur Radio has proven its worth time and again in emergencies. When disaster strikes, it is good that all services can work together and combine all available facilities for the public good. Now the telephone company cannot and does not object to the infinitesimal amount of competition offered by hams chatting long distance over the air. But when we use their own facilities to phone-patch a pleasure call in competition with them, you've got to admit that's getting a bit dirty. While the telephone company won't go broke from the loss of an occasional service charge, the reputation of Amateur Radio is far too valuable to allow it to be cheapened by so small a thing as that. What I have told about the telephone system so far, as well as what I am about to tell, is not by any means being revealed so that my brother hams can outsmart Mr. Bell, but rather, if the need should ever arise, that they might have the know-how necessary to make use of every available facility for the good of their fellow-men. In such a case as that, even the strictest of the telephone people would very probably go along with you. And so I clear my conscience with the reminder that you receive with this knowledge a responsibility to use it only to the greater credit of the fraternity. One clown can ruin things for all of us.

When it comes to coupling into a telephone line with equipment of other than Bell System design, we should look first at the broadcast stations. They do this sort of thing on a far larger scale than any other telephone company customer. In the broadcast industry the most common method is transformer coupling. Broadcast loops are generally treated as if they were 600 ohm balanced lines. Therefore, any 600 ohm transformer winding should offer a decent match. It is worth noting that the telephone people sometimes clear their lines with a high-power surge at around 500 volts dc. A blocking capacitor of sufficient capacity with a good high voltage rating can save you a lot of grief. Remember also that the 600 ohm winding only looks like 600 ohms if the other winding is properly matched. If the transformer has, for instance, a 10 K primary and a 600 ohm secondary, it must have a 10 K load across the primary. Also, some means should be provided to insure that the audio level does not exceed about 0 db, even if it means buying a meter. For those who want to stay on the good side of Mr. Bell, the telephone company makes available in many places a coupling transformer together with a telephone fitted to automatically remove it from the line when the receiver is down. After a $5 installation charge, it only adds 50c a month to your bill.

If you intend to record off the phone, remember that the law requires that a "beep" be sounded on the line, or that the other party know right from the start that a record is being made.

There are a number of low-priced induction pickups on the market which work by detecting the magnetic field of the autotransformer or of the earphone. These not only work, but they will also feed a signal into the line if the level is high enough. However, unless the other party is aware of it from the beginning, it may prove to be a violation of the federal wiretap laws. .

The diagram shows all the necessary

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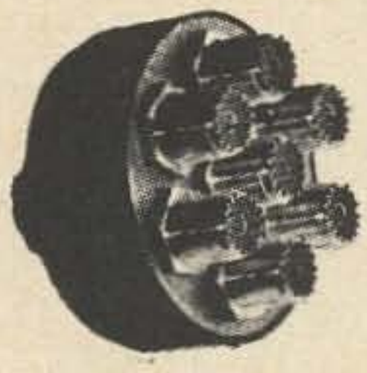

SP6T
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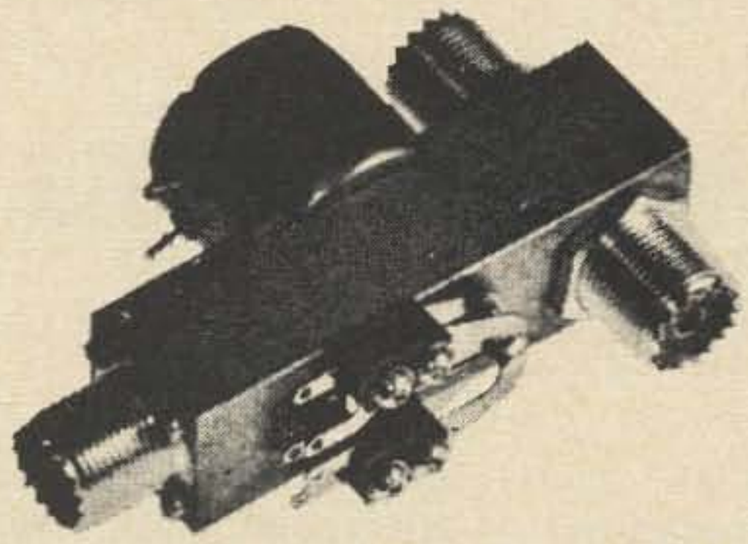
78-0604



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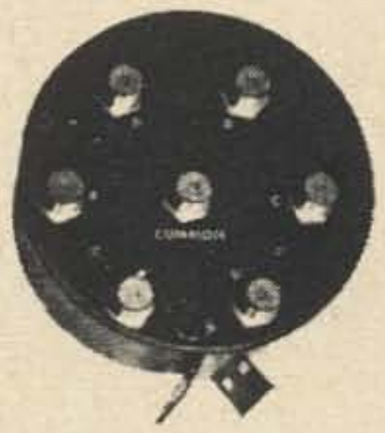

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SERIES 78 The series 78 coaxial switches are manually operated with true coaxial switching members (not wafer switches). They are offered in 2, 3, 4 & 6 position (illustrated) types, plus a transfer or crossover and DPDT. The useful frequency range is 0-1 Ghz except 500 Mhz using UHF connectors. The unused positions are open circuited or non-shorting. Also available with other type connectors such as N, BNC, TNC or C.

SERIES 60 The series 60 are remote operated, of rugged construction and designed for low-level to 1 KW use. The unit illustrated is equipped with a special high isolation connector ("G" type) at the normally closed or receive position. This "G" connector increases the isolation to greater than -100db at frequencies up to 500 Mhz, although it reduces the power rating through this connector to 20 watts. This is also available with other type connectors such as BNC, N, TNC,, C or solder terminals.

SERIES 71 High power 6 position switches commonly used for switching antennas, transmitters or receivers at frequencies up to 500 Mhz. The unit is weatherproof and can be mast mounted. The illustrated unit has the unused input shorted to ground. It is also available with a wide range of connectors, different coil voltages and non-shorting contacts or resistor terminations. Each of the six inputs has its own actuating coil for alternate or simultaneous switching.

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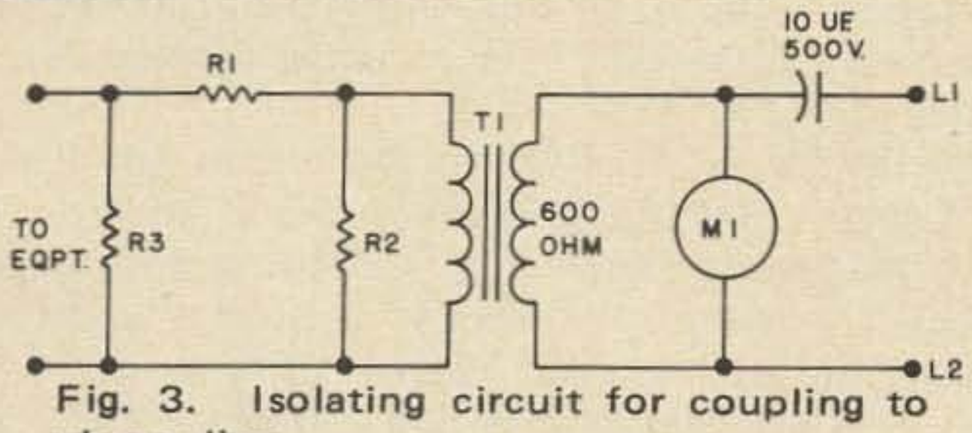

Fig. 3. Isolating circuit for coupling to phone line.

elements for coupling into or out of a telephone line. The three resistors may be entirely unnecessary if the primary winding of the transformer matches exactly the circuit feeding it. Using realistic values, however, it's perfectly possible to have a 20 K transformer and a 1 meg recorder or modulator input. If such were the case, R2 would have to equal the transformer impedance, (in this instance, 20K) R1 in series with R2 should equal the apparatus impedance (1 meg.) The values are different enough that R1 could be 1 meg, and the series combination of R1 and R2 would not make that much difference. With this arrangement, R3 could be left out. This could take audio off the line quite effectively, but it would have a 50:1 attenuation if you tried to feed voltage in. Much better to properly select your transformer in the first place. Taking another case, suppose you were using the same transformer as before, but feeding it from a 10 K source. R2 would still match the transformer, R3 would match the source (10 K), R1 would have to be about 10 times the larger of the other two (in the case, 200 K). If the apparatus had an impedance equal to the primary impedance of the transformer, you could then leave out all three resistors and there would be no attenuation. The meter, M1 is a standard VU or decibel meter to ensure that the lever going out onto the line were the same as that coming in (no more than 0 db). The capacitor serves to block against any high-power dc surge, and is picked so that the Xc is about 1/10 that of the line. I have given enough information for the ham who is reasonably proficient in the art to quickly calculate the proper values to meet his needs. In the interests of Amateur Radio, and also in the interests of the reader, if you cannot figure out the proper values with the information given here, I'd say don't mess with the line. Unless you really know your stuff, it's better for you to buy a pickup coil or pay the extra few bucks to the phone company for one of their couplers. . W2FEZ

Dave Mann, K2AGZ
One Daniel Lane
Kinnelon, New Jersey 07405

Leaky Lines

I've been lambasting the editorialist of QST for quite a while, on the basis of his ill-conceived piece last February concerning freedom of speech. After a couple of recent experiences, I have revised slightly my stated views on this matter, and would like to outline my current ideas on the subject.

You will recall that I opposed the notion that freedom of expression should be censored in any way. I said then that mature and intelligent people are capable of discussing anything under the sun without becoming emotional or insulting. I still feel this to be valid. Unfortunately, I did not take into account the fact that there are some who are not all that intelligent. I neglected to remember that there are people who will go out of their way, and seek deliberately to hurt, out of intolerance, bigotry, envy, or some fancied grievance.

There are many malcontents in this world, and we have our fair share of them in Amateur Radio. There are bullies, misfits, paranoids, and a whole range of peculiar types who are not prepared to maintain that degree of dispassionate detachment which would permit discussion minus any violent verbal abuse. The very existence of this group casts some skepticism into my mind now, about the wisdom of my words; I have misgivings.

It isn't proper, after all, to steer clear of foul language, if I'm going to turn right around and backbite some other ham. I may never utter a sacrilege, yet I may get away with slander, libel or I may bear false witness. Though I may avoid highly charged questions and political controversy, I may indulge in hypocrisy of the vilest kind.

There seems to be some idea that if a guy waves Old Glory and says he believes in the sanctity of motherhood and the home, he is then perfectly free to go on the air and express all kinds of poison, without fear of retribution. He can say anything, (so long as he doesn't cuss,) about another race, creed or color. He has only to avoid foul language, treason and sedition, heresy or irreverence, and he is within bounds.

I don't mean to suggest that we should not express dislike or disapproval. But, if you feel that someone is an unmitigated scoundrel or a plain louse, don't tell some third party about it on the air. It sounds horrible. Put it in a letter to him, or call him on the phone, and tell him. Or better yet, try to ignore the whole thing, and save yourself an ulcer. We'll all be better off.

* *

Apropos this question of contempt for others, I wonder if you've seen some "letters to the editor" from some of the younger hams. I'm getting a bit fed up with characters who automatically classify everyone over thirty an old fogey. They tend to put their age alongside their signature, as if to proclaim, "Look what a bright and precocious child I am."

They say we aren't keeping up with electronics, and call us a flock of doddering morons. What a crock of sophomoric sassafras! There are all sorts of persuasions in ham radio. But I warrant that the very first thing that attracted almost all of them, like almost all of us, was the ability to communicate; that's the name of the game. Theory, design, research, construction and other technical facets almost invariably are a later development.

Why does a teen-age kid presume to tell his elders that they have no right to indulge their own particular desires and aspirations? Are only the young entitled to "do their own thing?" How do some people arrive at the startling conclusion that anyone who does not share their standards is somehow unworthy? Where is the justification for this canard?

This hobby is all things to all hams, and if some of these child prodigies don't like it, perhaps they should forsake ham radio and cultivate astro-physics, brain surgery or some other field wherein they may breathe the highly rarified air of genius.

I resent any implication that everybody who has achieved adulthood is a doddering, senile cretin who once passed a test, and has been stagnating and vegetating ever since. Perhaps we have lost some of our bounce, to be sure; that's life. But there is one thing we like to think; we try to get along. We try not to be rude and discourteous to others, most of us. And, with few exceptions, we do not treat our ham colleagues with contempt and disdain.

I'd love to be around to hear what some of these "young Turks" will say, some fifteen or twenty years hence, when some college punk, still wet behind the ears, calls them dead wood, and says they ought to "shape up or ship out."

* *

First "beisbol." Then motion pictures and TV. Then the motorcar and airplane. Then moveable type, penicillin, radio and the carburetor. Oh yes, pity poor Robert Fulton and John Fitch; The Russians also invented the steamboat; or didn't you know that? What will they claim next? This reminds me of the old Gershwin song which went something like, but not precisely like this:

They all laughed at Ivan Tomashevski
When he said the world was round,
They all laughed when Popovich recorded sound,
They all laughed at Vronski and Polonski
When they said that man could fly,
They told Kazullski wireless was the bull-ski
That's the same old cry.....etc.

I'd like to say a few kind words about SWL's. Not so much extravagant praise, but merely some recognition for the impulse behind the cards we sometimes get via the bureaus. I've noticed that in addition to the information they convey, sometimes surprisingly comprehansive with respect to conditions, propagation, and so forth, these people often display marked ability to copy code. Somehow it makes all the little carping complaints of the anti-CW proponents seem a bit unworthy. The hams who propose dispensing with the code as a requisite for a license should devote some thought to this. The SWL wants to accumulate QSL cards from hams. He therefore sets about learning how to copy CW. There is no requirement that he do this. The achievement is its own reward. He has a goal, and this provides him with the necessary incentive. How then, can hams indulge themselves and abandon themselves to inertia and indolence, bemoaning their misfortune at having to meet code standards, at the same time knowing that non-hams are beating them at their own game?

I hope the time will never come when CW is done away with. Not only is it an efficient mode of communication, but a time-hallowed and traditional part of our historical development. Many a golden chapter in the shining chronicle of Amateur Radio would never have been written but for this, our first and most venerable method of transmitting radio signals.

* *

Remember how Charlie Correll used to answer the phone? "Hello. Dis is de Fresh Air Taxicab Company. Andrew H. Brown, president, speakin'." Then came the sultry voice of the temptress, Madame Queen. "Hello, Andy." Andy's tone of voice would change completely. "Heeeee-llloooo," he would drool.

I'm always reminded of this Amos 'n Andy bit, whenever I hear the following phenomenon.

A flock of guys are on the air, yapping about this and that; everything in general, and nothing in particular. Lots of kidding; references to graying hair or baldness, false teeth, and bulging waistlines. There's talk about grandchildren, mobile homes in Florida, and moaning over little aches and pains, bursitis and lumbago. In short, from all indications these gents are certainly well within the category of middle age, and perhaps just a teensy-weensy bit older.

All of a sudden a female voice is heard, 'way off in the distance, just about a smidgeon above the noise level. Immediately these elderly parties are galvanized into a strange and wonderful metamorphosis. In one fell swoop they not only develop super-acute hearing, but they seem to shed the accumulated years as a snake molts his skin. They revert to virile rooster-hood in an instant, and they become a gaggle of contending tomcats, serenading and caterwauling to some feline paramour from the backyard fence. They fall all over themselves in a spirited competition for the lady's attention. From the sound of the response to this tomatoe, you would think she was Raquel Welch, Brigitte Bardot and Sophia Loren, all rolled into one.

Next time you hear a YL breaker, pay particular attention to the atavism of all the old gaffers, and see if you don't get a great kick out of it. It's more fun than monkey gland extract, or a hormone injection, and who knows? It might just be the answer to the growing problem of geriatrics. There's nothing like a little old fashioned S - X to stimulate some life in the old bones, right?

* *

FAMILIAR SOUNDS DEPARTMENT

"Hello, CQ, CQ, CQ, from K2AGZ. Kilo two Alpha Golf Zulu calling CQ and standing by."

"K2AGZ. K2... ... Z. This is K ... ... Baker, wheeeeeeeeeeeeeeeeee.""QRZ, QRZ, QRZ. The station calling K2AGZ, please try again. QRM took you out. This is K2AGZ standing by for you."

"K2AG.....this is KR7 ... ... Whhheeeeeeeeee. Hello test. one two three four.....four three two one. Whhhhheeeeeeee squawk, splatter, squeak, crunch, bang, clang, crash, @†$%!&*() testing, testing, heeeeellllllllloooooooooo test."

"KR7 question mark. KR7 question mark, this is Kilo two America Germany Zanzibar. I'm not quite getting your call, old man. There's heavy QRM, would you try it one more time please? Over."

"Heeeeeeel111111111loooooooooo, test. BBBBbbbbbZZZzzz. RRRRrrrrRRRRRrrrrr. Burp, wah-wah-wah, tweet tweet tweet tweet. Whistle, tweedle-dee-dee. Hallllooooo, test. is anybody using this frequency?"

"Nobody is using it. Go ahead, old man. You're a real nice fellow. K2AGZ clear and QRT." * * *

* *

In keeping with my generally iconoclastic attitudes, I'd like to give the "back o' me hand" to all these self-appointed watchdogs who seem to have proliferated recently on the bands. These screwballs, of course, did not just appear out of nowhere. They were spawned, in my view, by a recent editorial in a certain magazine which saw fit to open a whole can of beans about self-policing ourselves.

Now, there's nothing new about this. Indeed, we have been discussing it for years. In fact, it is the number one subject of the speech made by the Director of any given section, at the annual roast beef dinner of the Radio Club. But this time it was a bit different. For the very first time, someone came out in print, favoring the vitiation of one of our basic Constitutional privileges, Freedom of Speech. But Freedom of Speech is like pregnancy or death. There's no such thing as a little bit of it. You either have it or you haven't!

A typewriter is like a gun. It will shoot anything you point it at. The man behind it must exercise good judgment at all times. In this

particular case the man behind the typewriter, obsessed with his own brilliance and wit, having to come up with a column about something or other, allowed himself to make an error of judgment . He exhumed this moldy fig from his mildewing trunk of ideas, never reckoning that it might raise a stench. And he underestimated the common sense of the readership!

For years and years hardly anyone ever took issue with the pronunciamentos which came down from New Mount Sinai, Connecticut 06111. Sacred cows, like other ruminants, become so absorbed in the chewing of their cuds that they develop total obliviousness to their surroundings; a sort of self-mesmerism. But in today's world things are different. There are no longer any sacred cows. Or, if there are, they simply are not venerated any more. Poor old Hirohito celebrated his birthday the other day, and it rated three lines on page 27 of the Paterson Evening News. 'When Mr. H. H. Humphrey crossed the street in St. Paul, a cab driver honked his horn and snarled at him, and two elderly Republican ladies made a rude gesture. Sic transit gloria mundi!

The Editor never considered that this piece would provoke a deluge of protest. Who woulda thunk it? Wonder of wonders? from the Sanctum Sanctorum an encyclical had been pronounced, yet it was not accepted unquestioningly as dogma. This was decidedly not the reaction he had anticipated.

So.....in the next issue but one, along with some of the letters of objection, the Editor wrote some minor retractions and statements of clarification, which sounded, for all the world, like backtracking. He had to, for clearly, the natives were restless. To the everlasting credit of amateur radio, people who rarely expressed any opinions at all, wrote articulate, intelligent, and even brilliant denunciations of this attempt to stifle free speech on the bands.

Of course, there were some who agreed with the editorial. I have heard a few of them, anonymously playing "vigilante" on the air, taking issue with those with whom they disagree. Mostly they concern themselves with an occasional hell or damn. One of these persons is a confirmed addict to the use of "By Golly" and "Jiminy Cricket".

Consulting my Partridge's Dictionary of Slang, I came up with the following. By Gosh, By Golly and By Gum are expletive substitutes for the Name of the Deity. Strange to say, the mild expressions, Goodness Gracious and Doggone It are similarly derived. Since one of the Ten Commandments expressly forbids taking the Name of the Lord in vain, somebody devised this method of cussing without actually being profane. Semantically speaking, however, the changed words do not change the substance or context; it's still swearing.

Jiminy Cricket, Jumpin' Catfish, Gee Whiz, Criminy and Cripes, are all derived from the Name of the Saviour, and their use is every bit as objectionable as would be the use of His Name, as innocently as they sound!

Shucks, Pshaw, Shoot and others beginning with the consonantal diphthong "sh" are all meant to take the place of that nasty pejorative which refers to a certain biological function, the less said about which, the better. In this group is included the non sequitur, horsefeathers.

Fudge and Phooey I leave to your imagination; this is a family type publication!

I hesitate to speculate upon the derivation of things like I'll be hornswoggled, or I'll be jiggered. But drat it, darn it, what the heck, and son of a gun are perfectly obvious to anyone with half an ear for sounds. I did not investigate either, into nifty, to get one's wind up, or the often used bodacious.

If you are interested in just how hairy this question of linguistics can get, just try using the terms, slowpoke or bugger, while talking to a Britisher. You're likely to get your head handed to you.

Well, what I've been driving at is this. I would far rather hear someone say an occasional hell or damn than some of those overdone cliches which are accepted as innocent. There is no valid reason for a Cripes man to look down his nose at a Hell's Fire man. If the latter were to say Brimstone and Ashes, or Perdition, it would not even get a raised eyebrow in polite society. Yet, the meaning is exactly the same.

Let's face it; language belongs to those who use it, not to those who would like to regulate and limit it. And if you really want to get down to cases, it's not really the words these people are gunning for. They are trying to shoot down the ideas that are expressed by words. And ultimately to take away your right and mine to express them.

* * *

Would someone please explain.....

Why the hardest thing in the world to get is an honest audio report.

Why the next hardest thing to get is a rotator that doesn't quit during the worst blizzard of the winter.

Where to find a ham who is satisfied with *your* S-Meter.

Why the guy with the most atrocious banana-boat swing is the most zealous opponent of electronic keyers, on the grounds that they rob fists of individuality.

Why your XYL insists upon using the vacuum when the signals are marginal.

Why certain hams send CQ at a swifter rate than their ability to copy, and when you match their sending speed exactly, they request you to QRS.

Why some ignoramus breaks, uninvited, into your discussion without identifying, and demands, "Why don't youse guys stop talkin' about all that political crap? Dontcha know that controversial stuff is outa bounds? What are ya anyway, a bunch o' commies?"

Why the lid who starts calling CQ on your frequency always says to the guy he hooks up with, "We're getting QRM'd. Boy, I dunno what's happening nowadays on the ham bands. There's just no courtesy anymore." But don't get me wrong.....I love Amateur Radio!

. . . K2AGZ

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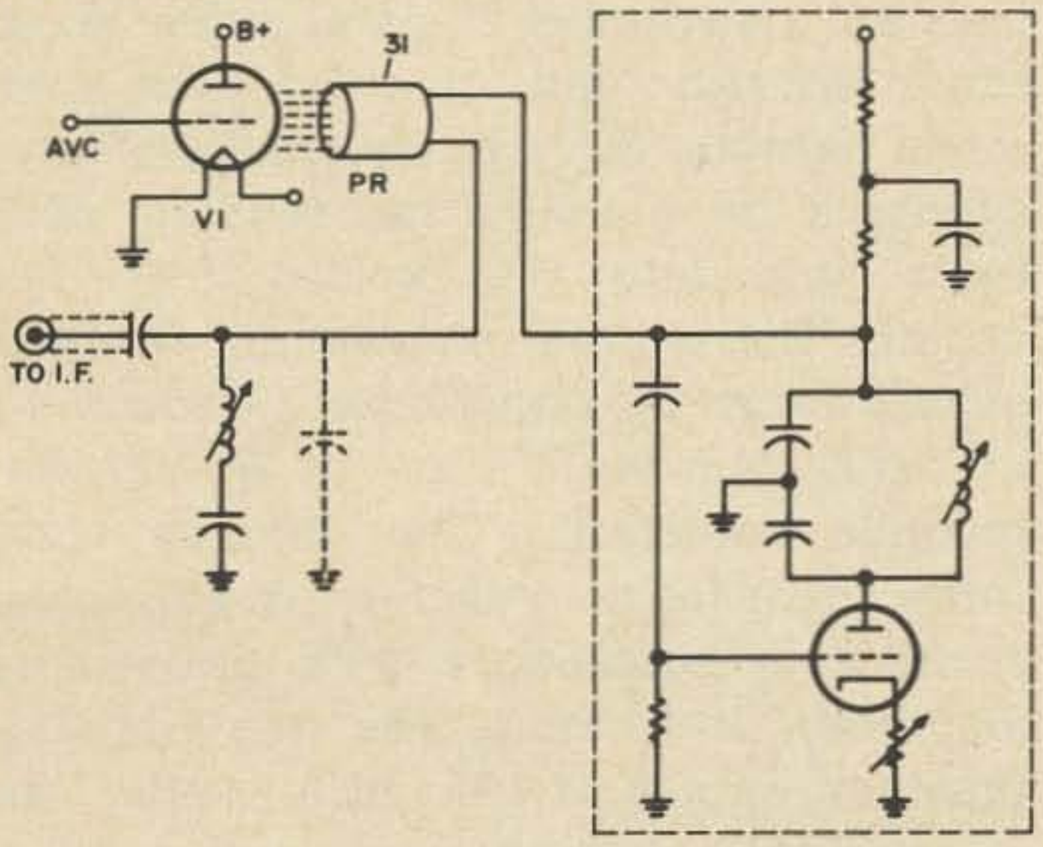
Autobandwidth

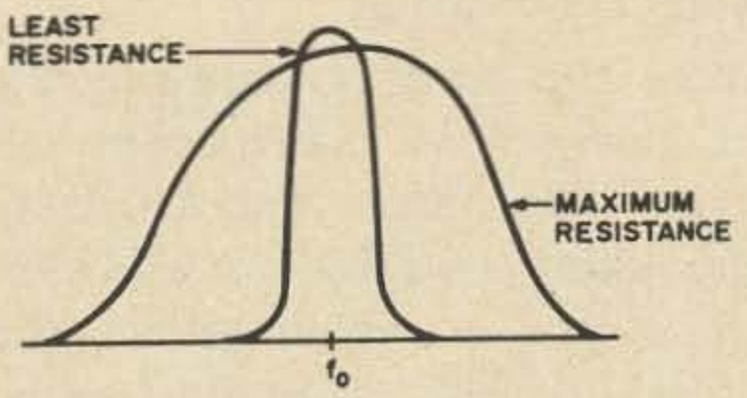
The accompanying diagram is an automatic bandwidth control circuit for the *if* strip of ham receivers. It will give a minimum bandwidth of 1800 hz, with a signal input at the antenna of 1 uv and the maximum *if* response for signals greater than 1000 uv. Since the choice of photo cell PR governs the actual extremes I shall not quote any figures.



V1 emits light and is controlled by the AVC.

Photo cell PR is in series with the Q multiplier set in its minimum bandwidth condition and therefore continually adjusts to the signal tuned. It is quite effective for weak signals, giving a better signal/noise ratio. It is operated by a simple switch.

The patent for this device was granted January 4, 1966, number 3,227,961.



In the actual unit many cells seeing different parts of the visible spectrum were tested.

Since the idea is simple, I will say no more.

Roderick A. Johnson, K1PIZ

George Wilson W1OLP
318 Fisher Street
Walpole, MA 02081

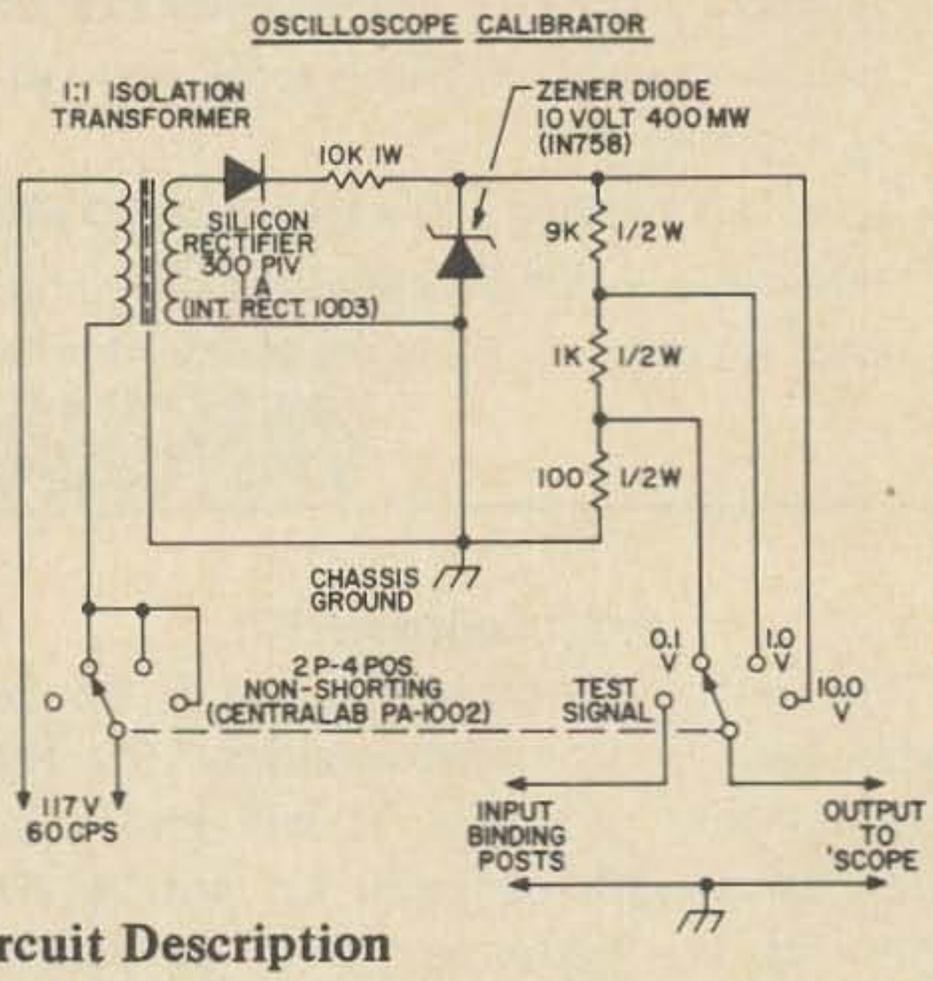
Scope Calibrator

Introduction

Instrumentation for the amateur who does his own design, construction and repair work has improved remarkably over the past twenty years! It is hard to imagine how we tuned antenna systems without VSWR meters and forward/reverse power meters. Most of us were lucky if we had a simple volt-ohm-milliameter. Those of us who knew what an oscilloscope was considered it far-out for application to our amateur problems. Today we have a wide range of instruments available, varying in sophistication from the spectrum analyzer ("Panadaptors" and similar instruments) to gadgets like the calibrator to be described in this article.

Functional Description

Perhaps the most frustrating aspect of using an inexpensive oscilloscope is its lack of voltage calibration. This frustration can be easily eliminated by the addition of an external calibrator which allows the signal under test and the calibrating signal to be switched without disconnecting and reconnecting the oscilloscope leads. The calibrator produces square waves of known voltage amplitudes. With one of these square waves applied to the oscilloscope's input terminals, the gain of the oscilloscope is adjusted until the signal height on the tube face is a convenient number of divisions when measured by the reticle in front of the tube face. Typically, a ten-volt square wave may by applied and the gain adjusted such that the square wave is ten divisions high on the reticle. Each division on the reticle is then equivalent to 1 volt. Similarly, if a one volt square wave were applied and the gain set for ten divisions, each division would represent 0.1 volts.



Circuit Description

The calibrator circuit (see circuit diagram) consists of an isolation transformer, a rectifier, a Zener diode clipping circuit, a step attenuator, and a selector switch. The isolation transformer minimizes the electric shock hazard. Note that an electrostatic shield between the primary and secondary is suggested to minimize the coupling of 60 hertz hum into the oscilloscope's input circuit. The rectifier reduces the sinusoidal voltage across the transformer's secondary to a "half sinewave," i. e., to a half-wave-rectified waveform. The clipping circuit further reduces the waveform to a form very close to a squarewave with peak-to-peak amplitude of 10 volts. The step attenuator provides outputs of 1.0 and 0.1 volts; these, and the basic 10 volt square wave, may be selected by the switch.

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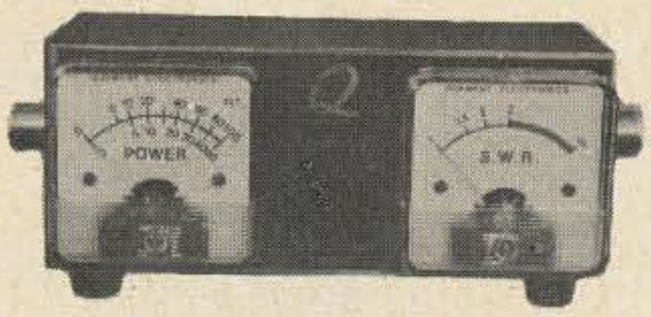

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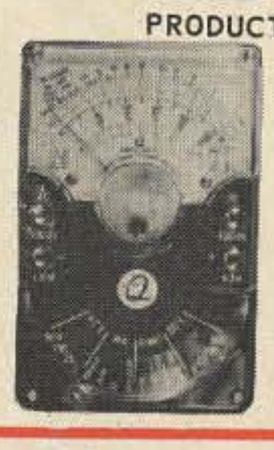

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Physical Description

The calibrator is built in a 2-1/4 x 2-1/4 x 4 inch minibox. The layout of parts is simple and not critical and, therefore, no drawings have been included in this article. Care should be taken to shield and separate the test signal leads from the 60 hertz calibration signal circuits.

A pair of banana plugs are mounted on 3/4 inch centers at one end of the minibox. These plug directly into the oscilloscope's input terminals. A pair of terminals similar to the oscilloscope's input terminals are mounted on the other end of the minibox and are used to connect the test signal.

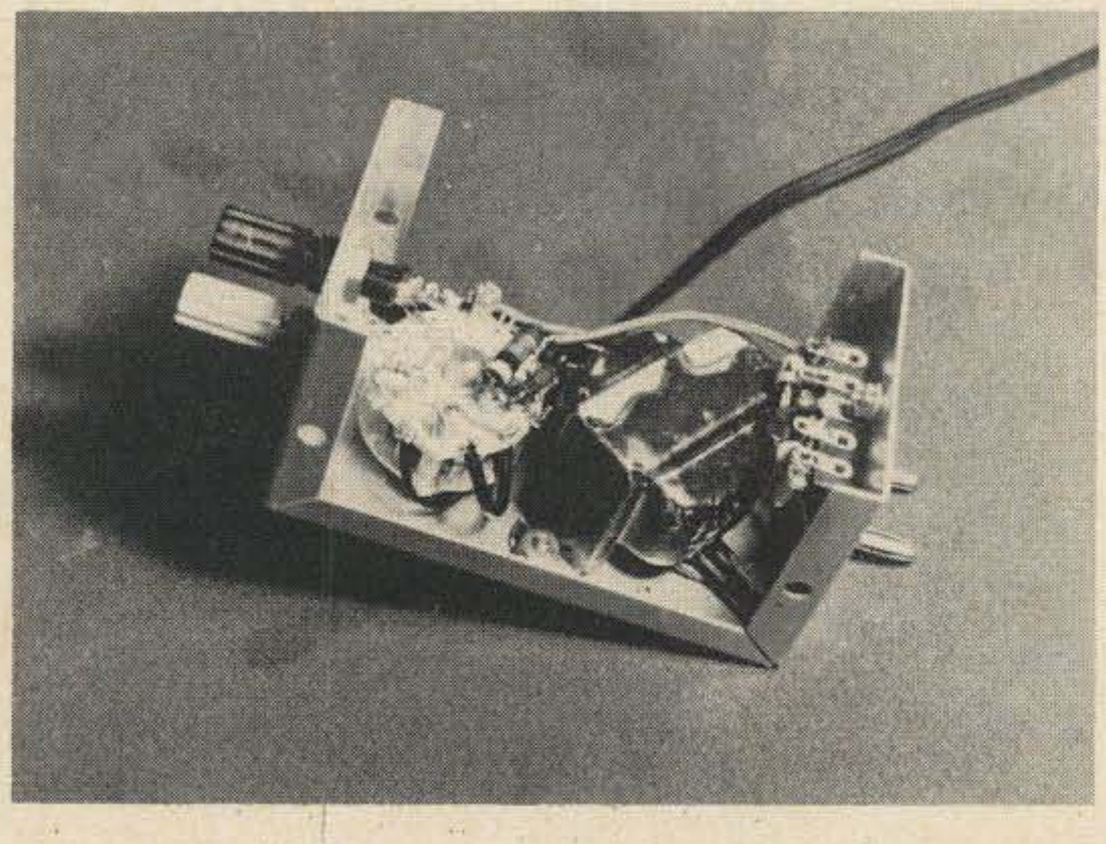
The switch has four positions: test signal, ten volts, one volt and 0.1 volts. This choice of calibration voltages will allow full-scale calibration of the oscilloscope in the range from 0.1 volts to 100 volts.

Conclusion

The convenience afforded by this calibrator makes it well worth its cost and the time necessary to build it. Its accuracy is governed by the accuracy of the Zener diode. The diode specified in the parts list will give 5% accuracy which is similar to the accuracy provided by common panel meters. Additional accuracy is probably limited by the oscilloscope's deflection linearity and the width of the oscilloscope's trace.

This device will greatly simplify work on both transistor and tube circuits. It makes an oscilloscope double as a vacuum tube voltmeter at minimum cost with the convenience of not having to connect a separate instrument to make voltage measurements.

. . . W1OLP



Vidiots That Have Known Me

Robert Manning K1YSD
Box 66
West Rye, NH 03891

"Hey, you, you jerk! Yeah you, the ham-operator dum dum!" A voice boomed out into the morning stillness and assaulted my eardrums as I was leaving for the unemployment office (I'm having trouble getting work in my chosen profession. There's not much call for a human cannonball anymore—especially since the last time out I overshot the net, carromed off the cotton candy machine, which ran amuck turning most of the audience into a cluster of Bo Jangles looking for a Shirley Temple, landed smack on top of the tatooed lady, turning her black and blue and obliterating most of her artwork, startled the fire-eater who hiccoughed and set fire to the bearded lady which scared hell out of the sword swallower, causing him to inadvertantly release the spring catch on a Malayan machette thus performing not only an auto-appendectomy, but much more serious damage. To this day, whenever he sees me, he kicks off his high heels, lifts his skirt and tears after me shouting all sorts of threats in a shrill voice! I don't know what his complaint is—they named a sandwich after him—sliced chicken).

The roar had emanated from one of my female neighbors—you know the type—so misshapen and ugly that if she'd been seen by Moses, there'd have been eleven commandments. She is the possessor of a cavernous mouth so large that, by comparison, a 7 ply 6:00x16 Goodyear white wall looks like a licorice-and-peppermint lifesaver. "Do you know," she thundered, "that every time you play with that radio junk of yours, my toast turns black and I start hearing things?"

Remembering item No. 32 from the pamphlet, "How To Handle TVI Complaints With Tact and Diplomacy," I deported myself like any other mature, gentlemanly, self-respecting ham would have done under similar circumstances. I jingled the change in my pocket, brushed back my Alan Ladd forelock, straightened my tie, wound my wrist watch, picked my nose, checked my zipper and, with a yell of "Blow it out your smokestack you beady-eyed daughter of an illegitimate pickpocket!", I hurled the largest rock I could find at the big-mouthed old bat!

Unfortunately, I missed the old bag—my knuckleball just isn't what it used to be—and

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hit her pet, "Heinrick," New England's largest living carnivore–a German shepherd–an animal with the mentality of a citizen bander, the disposition of a newly appointed "OO" and singularly devoid of any form of mirth who'd obviously read *Mein Kampf* and bore a grudge for losing WW II.

Taking refuge in my car, I watched the beast eat my fender, headlight, rear-view mirror and top it off with my two-meter halo.

Finally, fully gorged, fully sated and having vented his spleen, he started back towards his owner. I couldn't resist one parting reparté as I drove off in my now fender-light-antennaless car, and I said, speaking to the dog but in a voice loud enough for the neighbor to hear, "See ya, Heinrick, and tell your 'mother' (with all which that implied) that if she keeps hearing things, the men in the Good Humor uniforms with the snow-white, crepe-soled sneakers are going to certify her as a class "A" goober and wheel her off in a wire mesh basket wrapped in a wet bed sheet!"

As I rounded the corner on two wheels–chortling and wondering where I was going to get a fender for a '36 Hudson Terraplane, I heard a loud crash from the rear of the car. Later investigation showed that I had solved one of the old broad's problems. If she wanted any more toast–black or otherwise–she'd have to run an extension cord all the way to my license plate and trailer hitch.

This is but one of the 800 I.T.V.I. cases that I had been involved in during a five-year tour at a trailer park (ofttimes referred to as a "horizontal high rise" or "an instant slum"). [Now, if the type-setter has kept out of the Haig&Haig, isn't hung over and hasn't been distracted by a passing micro-mini skirt, as I suspect must have happened in three of my last four articles, since, in each case, a key word was changed, turning an otherwise humorous paragraph into a meaningless jumble of unconnectable words, you will notice that I said I.T.V.I.]

ITVI is a little complicated to define. The initials, of course, stand for Imaginary Tele-Vision Interference, but it goes much deeper and is more profound than simple imagination on the part of an arbitrary or isolated television viewer.

ITVI is the product of the bigotted and stagnated mind of *"The VIDIOT."* The Vidiot (Video Idiot) has become an ever growing ethnic group within our society–moving into "1984" and "Big Brother" twenty years premature. He is totally mesmerized by that flickering rectangular eye. His entire thought processes, eating habits and even his sex life are controlled by CYCLOPS! . . . CYCLOPS all hail the one-eyed God! . . . "Johnny has to be in bed by half past the Flying Nun" . . . "I want you home before The FBI" . . . "The roast will be done about quarter to ADAM-12 . . .

(One Vidiot I know of became so despondent when his set was removed for repairs that his wife was forced to light up the aquarium, sit him down in front of it and keep reassuring him that it was a Jacques Cousteau Special. When that wore off, she mixed him a "Missing TV set cocktail"–six parts prune juice to one part gin–the Vidiot knew the TV was missing, but he was too damned busy to really care.)

The Vidiot comes in two forms. The type that has jumped from infancy to senility completely omitting maturity, and the type that exists in a limbo state of arrested pubescence!

If you felt the urge for creative analogies, you could call them Vidicon Buddhists–differing from the "navel contemplating" Buddhists only so far as the location of the navel to be contemplated is concerned. The Vidiot searches for Nirvana through a transplanted electronic and transistorized navel installed in a cabinet, but is nonetheless connected to it by an ivisible optical/auditory umbilical cord.

Imaginary interference can be conjured up in the mind of a vidiot at the slightest provocation (especially during one of his favorite programs–like BOZO or Dark Shadows or the Late Night Movie showing, "The Oyster that swallowed Mt. McKinley"), and at the first flicker he can be expected to leap into the air with a rousing, "HUZZAH!", whip his bumbershoot out of the elephant foot, slam his purple pith helmet on his head, yank open the door, and, like some modern Don Quixote, wearing only the CD pith helmet, jockey

shorts and mucklucks and waving the bumbershoot in one hand and a TV Guide in the other, race into the night screaming, "I know you're out here—my TV is flickering!"

Where do vidiots come from and why do they hang to this outmoded belief? This fallacy—like burying a hank of hair and a fingernail at the full of the moon to rid yourself of warts, eating raw eggs to improve virility, or buying *Playboy* "just for the articles" has been passed on from vidiot to vidiot—stupidity is not contagious, but to *not* believe would mean that Cyclops is not infallible.

TV repairmen live in constant terror of a call from a vidiot where the set will have to be removed. The "sophisticated" repairman comes armed with COPE, NERVINE and MILLTOWNS; the "average" repairman simply brings along a leather strap or a bullet for the vidiot to bite on while the repairman pries his fingers off the fine tuning knob; but the uncouth repairman simply walks in and bludgeons the vidiot with the stubby end of an Indian club.

An ITVI or Vidiot call can almost always be distinguished within the first few words of the conversation. The vidiot has a tendency to "gild the lily," the voices he hears *always* "sound" like a ham, the lines he sees *always* "look" like the lines of a ham, and more often than not he'll claim that he's hearing Morse code.

You know this "frogmouth" wouldn't know Morse code if Marconi, Samuel B. Morse and Hiram Percy Maxim were all simultaneously hammering out "CQ DX" on the frontal lobe of his cerebrum with an axe handle, a No. 9 iron, and a croquet mallet respectively.

It was a common, rather than uncommon, thing to be interrupted during snoozes, showers and other nefarious activities by the ringing of Alexander Graham Bell's dubious contribution to moderna. (Incidently, I have definitely established that the first phone conversation was not "Mr. Watson, come here I want you!" but rather a call from the downstairs neighbor complaining that Mr. Bell's infernal machine was interfering with the operation of the neighbors' VICTROLA, making Enrico Caruso sound like a baritone!)

When the phone rings for a TVI call, as some of you are undoubtedly aware, it seems to possess a special tonal quality—sort of a cross between a death knell and the noise your car makes 30 minutes after you've mailed off the last payment.

Picking up the phone on these occasions I'd say in my most cordial manner, "Hello there! Whom have I the pleasure of addressing over this veritable miracle of electrical science?" After a slight pause, a voice would rumble back, "Listen you wacky nut—you're on my TV and if you don't stop it, I'm coming up there and whomp you on the top of the head with a 2x4 until you're bowlegged from the neck down!"

"Ah, forsooth," said I, remembering—be nice, be calm. "If you will tell me where you reside and abide, I'll come down and take a look at your TV, for, verily, I haven't had my rig on in almost a fortnight!"

"Whazzat? Whazzat? What the hell are you talking about? Huh? Huh?"

"I said, where do you live, stupid?"

Living as I did in a trailer court where your furthest neighbor was as close as 100 yards and where there were over 80 TV's within the area, I thought it a good practice to visit anyone with a complaint—just to keep good will up and rumors down. In all 800 cases, I never had a bona fide case of TVI attributable to me. This gave me a first-hand look at a continuing flow of vidiots which defies description. At one time I thought that I must possess some inner personal magnetism that attracted the lunatic fringe like ZSA ZSA attracts and accumulates jewelry.

With each call, I would dutifully don my "technical-type" coat—actually a sanitation engineer's coat which I'd appropriated at a Trailways bus depot—and picked up my Interference Portmanteau, which contained on one side TVI brochures, high pass filters, wave traps and some test equipment (all about as useful in ITVI cases as the "pill" is to an octogenarian). On the other side, I carried my Vidiot Analytical Conglometer.

In order to understand the V.A.C., you must first understand the mental workings of the Vidiot. He will not install a high-pass filter or a wave trap, even though they're free. He wants someone or something he can

blame, hate and rant about. The V.A.C. is my own design and is flexible enough to handle most vidiots.

The Vidiot Analytical Conglometer is housed in a 5x6 mini box. There are only three basic parts to it: (1) A small variac coupled to an ac meter and ac plug. The meter is labeled in five stages. Depending upon the vidiot you are dealing with, you can adjust your conglometer to read the cause of his problems as being A, the weather; B, the bomb; C, the Russians; D, rockets; and E, UFO's. (2) The second part is a 3" speaker with alligator clips to parallel to the output of the TV—if you can cause a feed back squeal, you can make him believe anything. (3) Appearance—the conglometer has got to look impressive. I have a rotatable tea strainer plumb on top and a two-section auto antenna on the side, plus a number of lights, knobs and other assorted junk.

I cannot possibly recount all 800 ITVI cases, but I can give you a typical incident.

Clad in my technician-type coat, I journeyed to the home of the complainer. My eyes had become accustomed to the dark by the time I arrived. (Vidiots always call at night.) So as I entered the dark, murky interior, I could easily make out the semi-prostrate form of the vidiot with his hair hanging down into his can of Black Label which he clutched as if it would take a skin graft to remove it.

I was immediately accosted by two animal forms. The first, a future vidiot—a sticky jam, tar- and glue-fingered, curtain-climbing, crumb-grabbing, rug rat that attached itself to my leg like Sinbad's "old man of the sea," shrieking and screaming something totally unintelligible (all vidiots have one or two of these around the house; and the second was the smallest, nastiest, noisiest, most pop-eyed Chihuahua that I'd ever seen.

"Clem," came a voice from the kitchen, "tell the man he won't bite!"

"The dog or kid, lady?" I asked. "I don't mind that bug-eyed canine chomping on my shin bone, but if that kid so much as breaks the skin, I want a tetanus shot right away!"

About this time, Clem, the vidiot, demeaned himself to notice me, and brushing the ashes and crumbs from his gravy and beer stained "T" shirt, he looked up but didn't get up, and in the vernacular of all vidiots, he said, "Dahh, so you're the ham bum that's been screwing up my TV, huh?"

"You tell him, Clem!" came the voice from the kitchen.

"Look neighbor," I said, trying desperately to drop the portmanteau on top of the dog while trying to get a death grip on the 40 pounds of animated garbage who was now not only trying to get his gooey hand into my pocket, but also doing his level best to break every bone in my instep. "I came down to see if I could give you a helping hand. I haven't had my rig on in several days—now where's the TV set?"

"Don't gimme that crud!" he said.

"Tell him off, Clem," came from the kitchen.

"I know all about you hams . . . yeah, we had one of you guys back in Oklabraska—soon as the old man left, the old lady'd get on there and start making dates all over town. Then the kids would get on there and talk to each other," he grumbled officiously.

"Tell him, Clem!" came the voice from the kitchen.

"And another thing," he said, turning to get another beer (I seized this opportunity to Norden Bombsight the goddamn dog and surreptitiously twist the kid's ear a full 180 degrees—both went screaming—louder, if that's possible—into the kitchen), "That big antenna of yours is sucking all the power out of my set."

"Tell him off, Clem!" came the voice from the kitchen (unbelievably over the wailing din of a scrunched dog and a twisted-eared kid).

"You suppose you could show me the TV set and keep the commentary for later," I said.

"Smart Bustard, huh? That's it over in the corner. Maw had it for 15 years and we've had it for 5. Never had any trouble except for you hams," he said, indicating a large, brown crate about the size of a restaurant freezer with what appeared to be a broken coat hanger with tinsel hanging off it.

"Where's the screen?"

"Right there, that six inch hole, see the flickering? You're doing that. See what you're doing? Huh? Huh?

"Tell him off, Clem," came from the kitchen.

"I'm standing right here, so what can I be doing? You ever think about having 'er stuffed?"

"The TV?"

"No, that voice from the kitchen!" Ducking a beer can, I continued, "Buddy, this set is 20 years old and the only way you're gonna get a picture on it is with the help of Timothy Leary!"

"Who's he? Another screwy ham?"

"Tell him, Clem," came from the kitchen.

"Ya know, friend," I said, "I could solve all your problems just by inserting a small piece of lead in your left ear!"

"That would fix everything up, huh?"

"As far as I'm concerned, it would!"

"How would you insert the lead?"

"With a .38 Smith and Wesson . . .

. . . **K1YSD**

(Type-setter's note: I am not distracted by micro-mini skirts. However, the editor's Bermuda shorts occasionally catch my eye . . .)

Mobile Transmitter Heater Switching

In amateur FM communications operation long periods are spent monitoring a sometimes vacent channel with relatively few transmissions. When I converted an old rig to put in my car, it soon became apparent that keeping the transmitter filaments hot would result in a considerable power waste from the already overtaxed car battery. The receiver uses many filament type low current tubes, but the transmitter heaters waste power. The rig is remotely controlled in the trunk by a control head and connecting cable. No means was provided to allow separate switching for the transmitter heaters.

To solve this problem I devised a switching method that allowed the desired control, but with no extra switches or cables on the control head. The scheme is shown in Fig. 1. When the receiver is turned on, the transmitter filaments will not be turned on until the microphone push-to-talk button is pushed. When the button is pushed, the T–R relay and K1 will be activated. As K1 pulls in, it in turn turns on K2. One set of contacts on K2 activates the transmitter heaters, and the other set of contacts holds K2 in continuously. When you wish to turn the transmitter heaters off, simply momentarily turn the receiver power off and the voltage to K2 will be gone. The receiver can then be turned on without activating K2, unless the push to talk switch is activated.

In my case, K1 was not necessary because the T-R switch had an extra pair of contacts. Be sure that the contacts of K2 can handle the current that your transmitter requires. Six volt relays can be used with series resistors calculated from Ohm's Law, although this will add to current drain.

This system can increase power waste during transmission because of the relay current, and some people may not like to wait for the transmitter to warm up. However, this was a good solution in my case because of my style of operating and limited activity on our local channel. If you don't like to waste power, and you don't like to run cables and install switches where there is no room for switches, this system may solve your problems too.

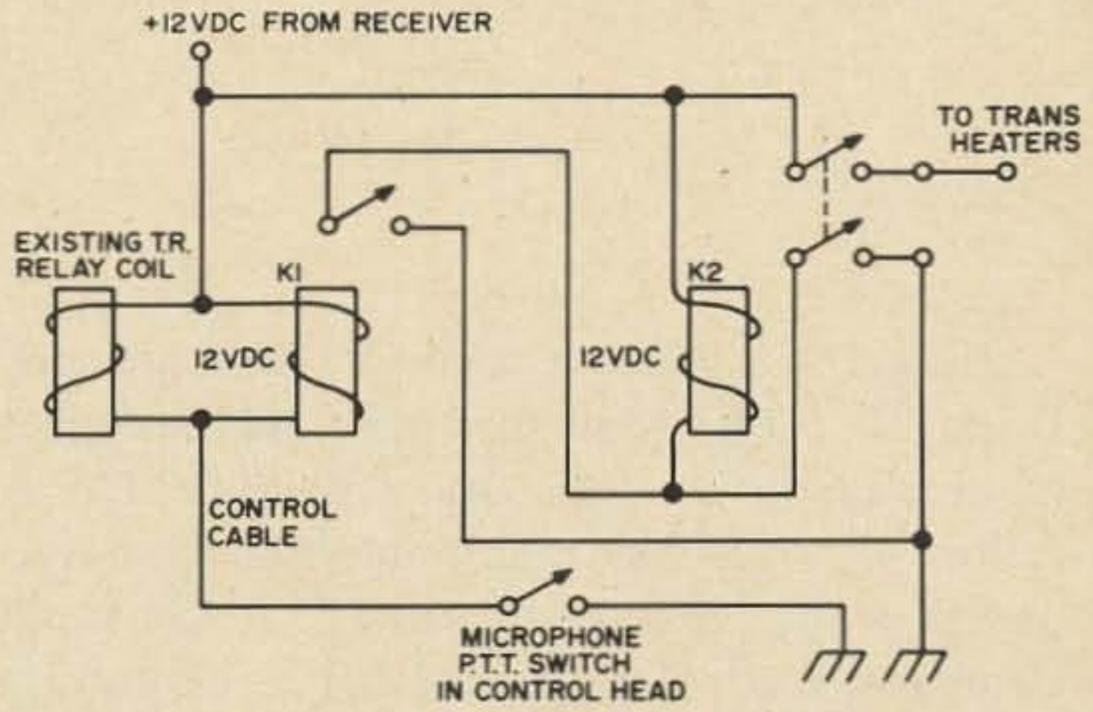

Fig. 1. Power saving heater control.

Clifford Klinert, WB6BIH

MOVING?

Every day we get a handful of wrappers back from the post office with either a change of address on them or a note that the subscriber has moved and left no address. The magazines are thrown out and just the wrapper returned. Please don't expect us to send you another copy if you forget to let us know about your new address. And remember that in this day of the extra rapid computer it takes six weeks to make an address change instead of the few days it used to when we worked slowly and by hand.

Don McCoy WAØHKC
4250 Hoyt Court
Wheat Ridge CO 80033

The Protector

Here is a practical circuit to have around. It can be used for protecting your ham gear or perhaps your expensive new color TV. A fellow at work was telling me how his house power went on and off three times in rapid sucession during a storm. He and his family were watching their color TV at the time. After the power settled down, his TV didn't work and it cost something like $130 to get it all straightened out. This got me to thinking about what such an occurence could do to my new solid state color TV.

The Protector is what I came up with. Here's how it works:

When 115 volts ac is available at the plug, and the fuse is good, the Reset Ready light will come on through pins 2 and the normally closed pins 5 and 8. Then you press the momentary Reset pushbutton. This operates the relay by putting 115 volts across pins 7 and 2, which is the relay coil. When the relay operates, the Reset Ready light goes out due to pins 5 and 8 opening. Pin 8 closes to pin 6, which is wired to pin 7 and the relay "locks up" through its own contacts and stays operated even when the momentary pushbutton is released. The 115 volts for the output receptacle is taken from pins 6 and 2 which are in parallel with the coil. The "Thyrector" across the output is to limit any surges or transients in the house current.

If the power should go off or dip to about 85-90 volts on my particular one, the relay will drop out, opening pins 6 and 8. Now even if the power comes right back on, there is no path to energize the coil or supply power to the output receptacle. The circuit will stay this way until the reset button is pushed.

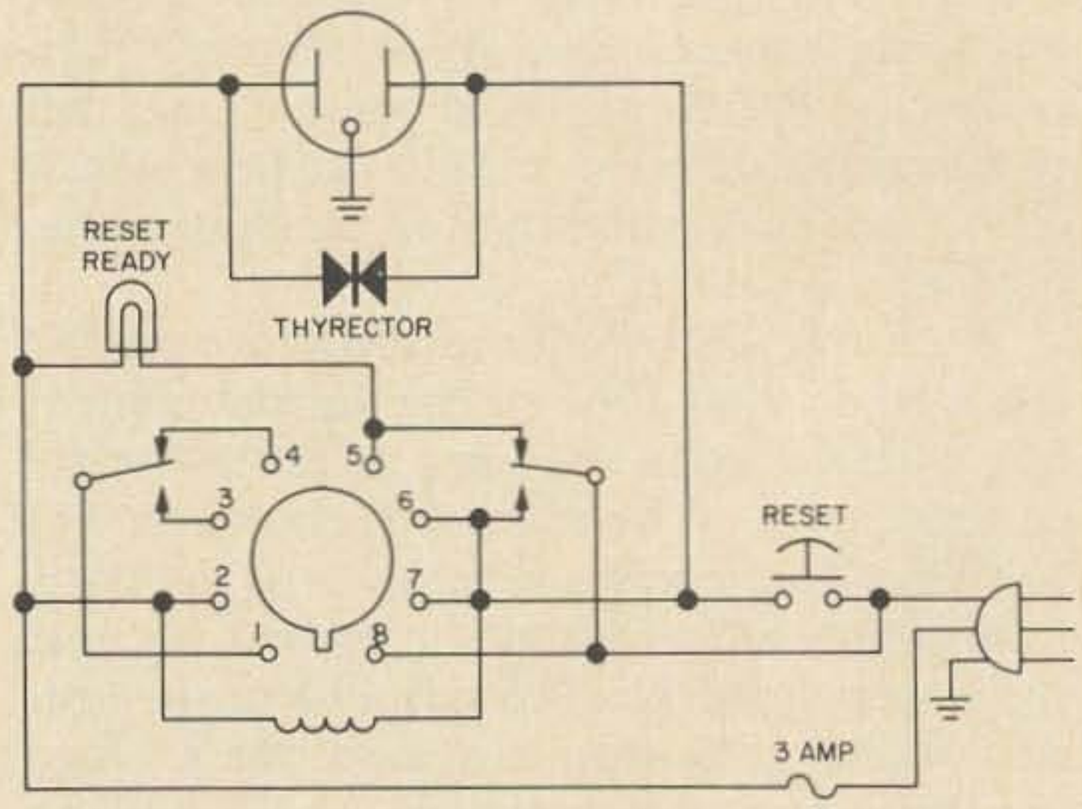

Fig. 1. Diagram of the protector using a G.E. thyrector, No. 6RS20SP606.

I used a Potter & Brumfield KRP11AG because I had one around. Just about any single-pole double-throw relay which has the contact rating that you need will do. None of the parts are critical. The "Thyrector" and Reset Ready light are kind of an optional item. Depending on your junkbox and scrounging ability, the whole thing shouldn't cost more than a couple of bucks.

I have mine between the color TV and the outlet now, and it has been working fine.

. . . WAØHKC

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Slower Tuning Rates for Older Receivers

After the oscillator has been stabilized, the front end sensitized, and the *if* crystallized, older receivers still lack a feature which makes the newer products attractive despite their cost. That feature is a slow, smooth tuning rate that allows one to tune across and with the signal rather than by it. Modern receivers have tuning rates varying from ten to 25 khz per revolution of the dial. In addition, they are free of backlash and have that smooth-as-velvet feel. Touch is part of what sells the browsing ham on the display model in the radio shops.

A couple of years ago, W7ZC/W5CA published an idea for slowing down the tuning rate of the Drake 2-B. Basically, he mounted a Jackson Bros. drive externally on the panel of the 2-B, using the holes already there for panel screws. Thus, he could replace the original dial whenever he sold the receiver without leaving any tell-tale signs of his modification. To add the drive, all he needed were a plate to mount it on and some L brackets to anchor the plate to the panel. The idea is adaptable to almost any of the older receivers around and will give a truly modern tuning rate plus the backlash-free velvet feel that comes from ball bearing verniers.

Since there are still plenty of older receivers around just waiting for modification, the original idea could stand some updating. It had a couple of drawbacks. With the 2-B, for example, moving from 40, 20. or 15 to 80 or 10 meters means shifting the dial from one end of the scale to the other. It takes a while at 7 khz per revolution to do this. In fact, one could miss a ten meter opening while getting to the left end of the scale. Secondly, the W7ZC mounting precludes use of the tuning dial scale. Although calibration of the theorectically 40 khz scale was not accurate because the oscillator was not linear, the scale was useful for logging purposes when one needed to find a station again.

By revising the mounting scheme and chosing an appropriate dial to replace the original, it is possible to overcome both flaws. In fact, one could even add a logging scale to receivers not already having one. With a little practice, interpolation of frequency to tenths of a khz is possible and practical.

The first job is to find a dial that will permit the use of both the 6-to-1 reduction and the straight-through features of the Jackson drive. That part is easy. The Galaxy-transceivers and the WRL Duobander use a dial which internally holds a Jackson vernier unit. If you order one or the other from WRL as replacement parts, make sure you order all the pieces and ask for the hardware. They didn't send the little 2-56 screws to fasten the straight-through dial to the vernier, but perhaps this was an oversight. The difference between the Galaxy and the Duobander dials is that the former has a logging scale already scribed on the outer dial. If your receiver does not already have such a scale, this dial just might fill the bill. You might also want to get the little plastic piece that serves as a setting marker. Since I have a 2-B, I ordered the Duobander knobs.

Before showing how to mount the new dial, I should warn that anyone used to a

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large tuning knob will find the two-speed dial awkward at first. It takes two fingers to turn, and the straight-through takes effort, since it has to move the little knob at six times the speed. It is a case of mechanical disadvantage. No more one-finger spinning from one end of the band to the other. But the whole point of the two speed dial is to be able to get to the part of the band which interests us and then to have really fine tuning.

A tip on tuning technique: don't tune overhand. It will tire you out in a few minutes. If the dial is low enough, rest the back of your wrist and hand on the table and tune underhand. The technique gives you smooth tuning and a precise feel. Your hand and arm muscles work only at tuning (which takes little effort) instead of tuning plus supporting the arm and hand (which takes a lot of effort). Little things make the difference between pleasant operating and tiring battles.

With the WRL dial, the whole assembly can be mounted closer to the panel than W7ZC described. The Jackson drive extends only about a 32nd beyond the dial. Using the sketches as a guide, mount the dial and drive on a plate the same diameter as the dial on one side, and as long as necessary on the other. The rounded side allows you to mount a calibration scale behind the dial, which is about the same diameter as the original 2-B dial. Since the plate is needed only to prevent rotational movement (the shaft does the main supporting job), it need not be heavy or large. Eighteen guage aluminum or slightly thicker bakelite is fine. For the 2-B, I cut a second piece that crosses the extension as a T in order to fit the panel holes available. Cutting the original as a T would work just as well.

The two-piece version has an advantage: it allows final alignment so that everything turns smoothly. It is a good idea to drill all screw holes in a slot shape and to let the screws and lockwashers do the job of holding things in place. No matter how carefully I measure, I am always a bit off with the drill. After getting fed up with the modification because the drive would bind, I realized that it wasn't lined up properly. The slots let me tighten the drive to the shaft first and then align the plates to it. Now the drive works as smoothly as without any load.

By using 4-40 screws (which fit through the sheet metal screw holes without reaming them out) and a bunch of extra nuts I had lying around, I solved the spacer problem. I

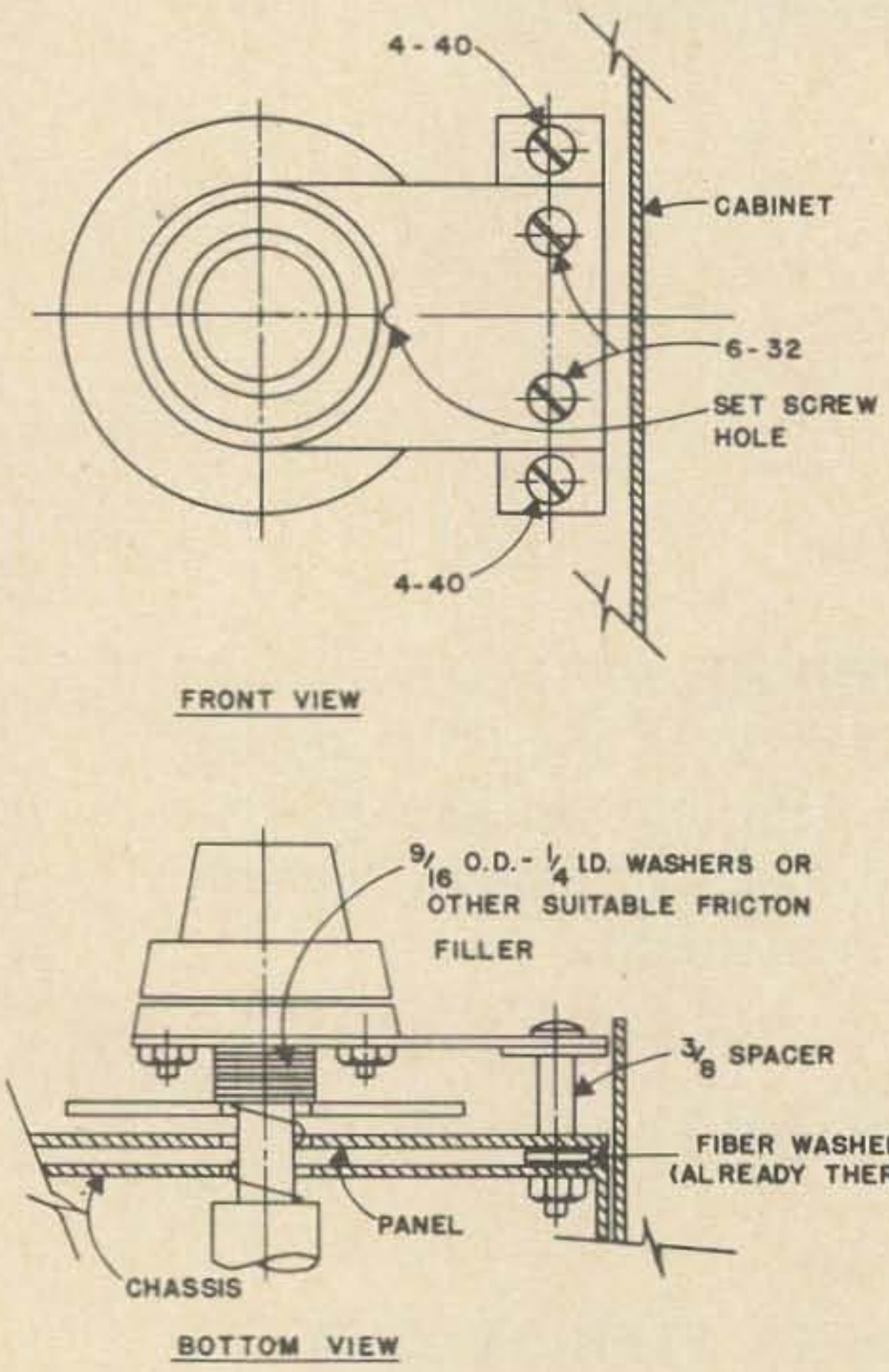

Fig. 1. Mounting of plates and two-speed dial/drive as applied to the Drake 2-B receiver. Modify as required by the particular receiver being adapted for a slower tuning rate.

recommend 3/8 inch spacers, but 1/4 inch spacers with solid washers on top and fiber or felt washers against the panel to prevent marring will do as well. For other receivers, the size of the spacer will depend on how far out from the panel the dial shaft extends.

The shaft of the drive requires a half to 5/8 inch hole. I used the larger size because I wanted to keep the 2-B calibration plate. It is kept turning by a spring on the dial shaft pushing against the plate which in turn pushes against the dial. Since the Jackson drive does not push onto the shaft as far as the original dial, there is space to be filled up. Tubing with an inside diameter of 1/4 inch of either metal or plastic, or even a gob of electrical tape wound around the shaft will do nicely. The aim is to keep the plate turning with dial rotation but to allow freedom enough to reset it at will. I had a large number of 1/4 inch inner and 9/16 inch outer diameter washers which slid very nicely onto the shaft. Just choose the right number for the shaft length to be filled up. The advantage of the washers is that if something binds, the washers will turn against each other so that nothing is damaged. But under normal tuning, they turn as a unit because of their friction contact with the shaft and with each other.

The same idea can be applied in adding a scale to a receiver without one. The 2-B backs up the spring by a wide margin on the shaft. A washer against the panel, a spring, another wide washer, and then a felt washer with a drop of oil on it against the back of the scale plate will allow the plate to turn freely if something heavier on the friction goes between the plate and the drive. The gob of tape or a metal spacer with *dry* felt washers on either end will do the trick here.

For a professional look, paint the metal plate holding the dial black or to match or contrast with the receiver panel and knob. To impress your friends with your home brew ability and with the fact that you are one up on them with the same old gear, leave it a shiny aluminum or raw bakelite. The entire job is quite simple (about two hours work), but it gives the impression of immense complexity and ingenuity. And when you tune in your calibrator note and can hear it for a couple of revolutions of the

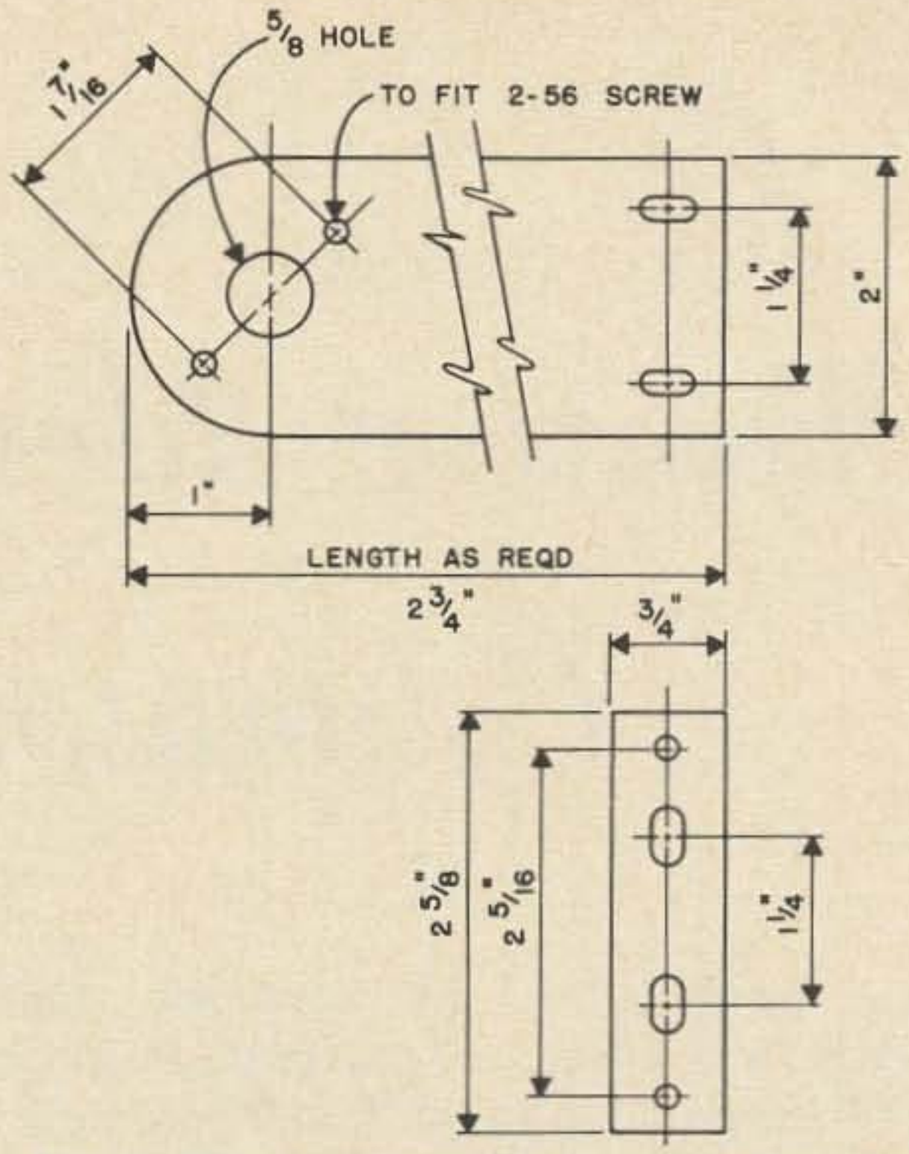

Fig. 2. Plates needed for mounting two-speed dial/drive. Adjust dimensions to fit particular receiver being modified.
Note: dimensions of slots not critical, but keep slots aligned as shown. Reversal of directions allows plate holding the dial to slip more easily as the dial is rotated. Lock-washers are essential in fastening the two plates together.

dial, you will amaze everyone, including yourself.

The real advance is in operating ease. With a slow tuning rate, you will hear stations that you previously passed over as part of the popping line noise and QRN. Now they have a tone that rises or falls depending on which sideband you are tuning. "You can't work 'em if you can't hear 'em", is an old saying, and we can add that being able to recognize a signal is half the job of hearing the hard ones.

An ultra-slow tuning rate is useless without a stable receiver. Some receivers drift faster than one could turn the knob of the new drive to follow them. That is another place the straight-through knob comes in handy. But stability comes first on the receiver modification priorities. Once you have achieved that or have a receiver like the 2-B, which remains stable even as it grows old, then you can concentrate on tuning rate and calibration. Here, the WRL knob and the Jackson Bros. drive really help. And this is the point where I came in.

....W4RNL

*David Middleton, W7ZC/W5CA, "Slowing Down the Tuning Rate on the Drake 2-B," 73. September, 1965, p. 44.

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Positive Identification of Calibrator Harmonics

The availability of low-cost high-frequency transistors and integrated circuits has made it possible to build inexpensively a 100 khz crystal calibrator with useable harmonics extending into the region of 400 to 500 mhz.[1] This means that you will have perhaps 4,000 or so crystal controlled signals available, all of which sound exactly alike when tuned in on a receiver. It is a real problem, therefore, to determine which harmonic of 100 khz is being received at any given time.

The usual method of identification

On the lower frequencies, when using a general coverage receiver, you can tune to WWV at some known frequency, and by carefully tuning away you can count the number of 100 khz harmonics tuned through until you reach the desired frequency. For example, if you wish to locate 7.0 mhz, you can first tune to WWV at 5.0 mhz, then tune higher in frequency until you come to the twentieth 100 khz harmonic above 5.0 mhz. This will be exactly 7.0 mhz. Of course, you must be sure of which WWV signal you are tuned to, but since the WWV transmissions are spaced at such wide intervals (2.5 mhz between the 2.5 and 5.0 mhz signals, and 5 mhz between the 5.0 through 25.0 mhz signals) there is little likelihood of making a mistake, even with a poorly calibrated receiver.

Possibility of error

With a limited-coverage receiver, such as the ham-bands-only type, you can tune to 7.0 mhz and perhaps you will hear a 100 khz harmonic at this dial setting. This is probably the 70th harmonic of 100 khz at 7.0 mhz, but it could also be the 69th at 6.9 mhz or the 71st at 7.1 mhz, and the indication would still be exactly the same.

At higher frequencies even a receiver with a wide tuning range will have the same difficulty. For example, say you build a receiver covering the range of 100 mhz to 120 mhz. A grid-dip meter will get you somewhere near the desired range, but the 100 khz calibrator will be useless for accurate calibration because you will be unable to positively identify any of the 200 or so 100 khz harmonics that you will be able to hear.

What is needed is some means of giving each harmonic some characteristic that would distinguish it from all of the other harmonics generated by the 100 khz calibrator.

A new method of identification

A simple way to do this would be to use two crystal calibrators. One calibrator would operate at exactly 100 khz, while the other would be adjusted to operate slightly above

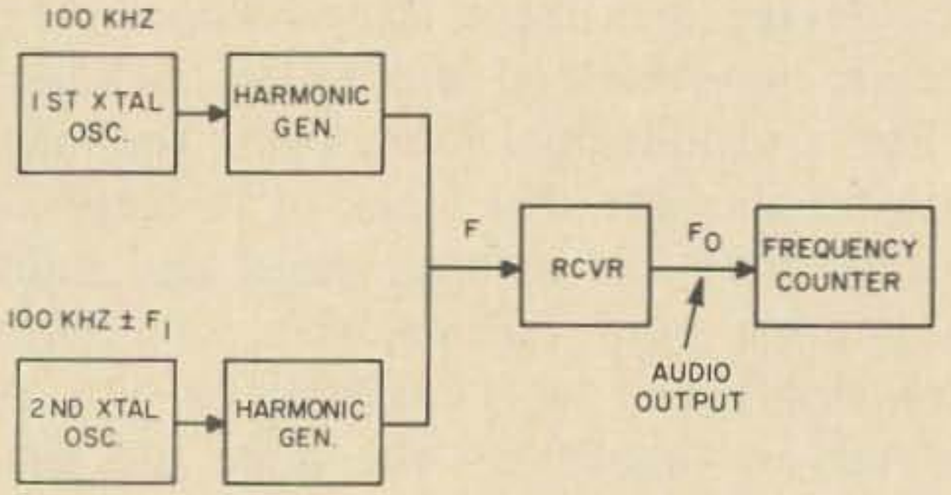

Fig. 1. Block diagram of proposed method of identifying 100khz calibrator harmonics. f=frequency of 100khz harmonic tuned to. f1=frequency difference in hertz between first and second oscillators. fo=audio output frequency in hertz.

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or below 100 khz. Let's see what would happen if the second oscillator frequency were made 100 khz plus 10 hz, or 100.01 khz. The 100 khz and the 100.01 khz signals are fed simultaneously into a receiver that is equipped with an AM detector. If the receiver is tuned to 100 khz, there will be audio output signal, the frequency of which is equal to the difference in the two oscillator frequencies. In this case the difference is 10 hz.

Now we will tune the receiver to the second calibrator harmonic at 200 khz. The second harmonic of the 100 khz oscillator will be 200 khz, and the second harmonic of the 100.01 khz oscillator will be 200.02 khz. The difference frequency is now .02 khz, or 20 hz, which is the audio output frequency. The third harmonics of the calibrators would be 300 khz and 300.03 khz, which would give an audio output of 30 hz, etc.

As we go up in frequency the spacing between the calibrator harmonics becomes greater and greater, increasing exactly 10 hz with each consecutive harmonic. This could theoretically continue until you reached an output frequency of 50 khz, but the *rf* and audio bandwidths of most receivers would prevent going this high.

In order to determine which harmonic we are tuned to, we only need to measure the frequency of the audio output tone in hertz and divide by 10. Multiplying this answer by 100 khz will then give the correct frequency. After determining the frequency, you can turn off the oscillator with the 10 hz frequency offset and zero the receiver on the exact 100 khz harmonic for an accurate calibration point.

Now if you tune a limited-coverage receiver to 7.0 mhz, and with both calibrator oscillators running you have an audio output of 700 hz, you can be certain that you are actually tuned to 7.0 mhz. This is the only frequency, for all practical purposes, where you would have a 700 hz output frequency. 6.9 mhz would give an output of 690 hz, while 7.1 mhz would give an output of 710 hz, etc.

Technical details

The audio output frequency would have to be measured very accurately – at least to the nearest 10 hz or whatever 100 khz frequency offset you may be using. A frequency counter would probably be required to get accuracy of this order. This is no longer the hang up it would have been a few years ago. The introduction of inexpensive integrated circuits has made it possible to build a good frequency counter at relatively small cost.[2,3] Some of the older tube-type counters are also available at surplus outlets at reasonable prices.

For our purposes the counter would only need to be capable of measuring the audio frequencies. The bandwidth of the receiver would be the limiting factor in most cases, and the 100 khz frequency offset would have to be set so as to get a useable output from the receiver when tuned to the desired 100 khz harmonic. For example, if the receiver bandwidth is 10 khz, with a 10 hz offset the highest measurable 100 khz harmonic would be the 1000th, or 100 mhz. With a 5 hz offset you could measure to 200 mhz, with a 20 hz offset you could measure to 50 mhz, etc.

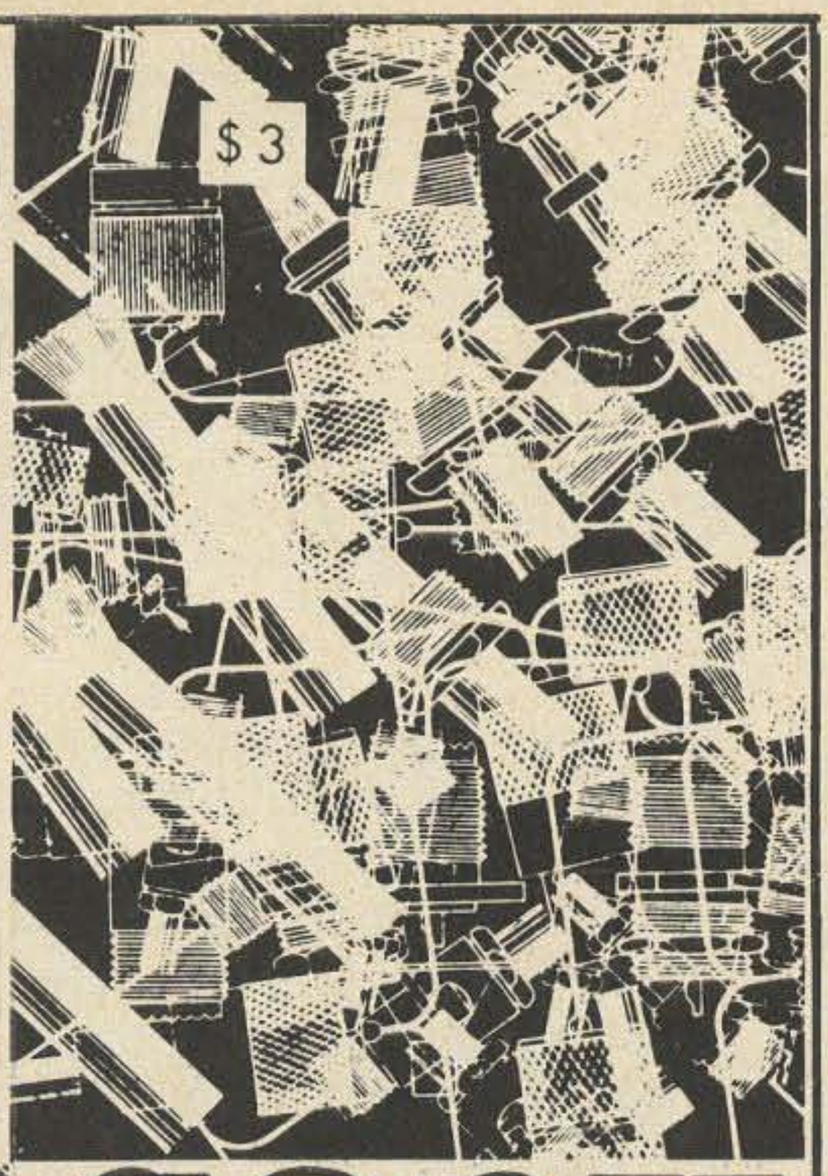
The two calibrator oscillators must be accurately adjusted to their proper frequencies. In order to set one oscillator to exactly 100 khz, first tune the receiver to WWV at the highest receivable frequency where a steady signal can be heard. Wait until the tone goes off (the last two minutes of each five-minute period) and adjust the calibrator frequency for zero beat. Watch the receiver S-meter. When you are close to zero beat, the meter will begin to move back and forth at a rate equal to the frequency difference. Adjust the oscillator trimmer carefully until the meter moves very slowly and then stops. This will be exactly the 100 khz point.

The other calibrator can be offset the correct amount from 100 khz by using the counter to measure the beat note between it and WWV. For example, with a 10 hz offset you would adjust the oscillator for a 1500 hz beat note with WWV at 15 mhz (the 150th harmonic of 100 khz), or a 2,000 hz beat with WWV at 20 mhz, etc.

The 100 khz calibrator oscillators must be very stable. A transistor oscillator built with high quality parts and powered by a mercury battery would probably meet the requirements. A simple 100 khz transistor oscillator developed by the National Bureau of Standards has a short-time frequency variation of about three parts in 10,000 million, and a long-interval variation of about three parts in 1000 million.[4]

You would have to take care that the oscillators would be subjected to as little change in temperature as possible. Of course, if similar parts are used in both oscillators, it is probable that they will drift at approximately the same rate with temperature or

73 special



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voltage changes. Thus the relative frequencies of the oscillators would not change, and the location of the received harmonics would still be correctly indicated.

Receiver stability would not be a determining factor in the accuracy of this system, as long as the calibrator harmonics could be held within the pass band long enough to enable measurement of their frequency difference.

Since this output frequency is the result of the calibrator harmonics beating against each other in the AM detector, a slight drift in the receiver local oscillator will not cause a change in the output frequency, but only a decrease in its amplitude.

Considerable thought has been given to the ideas expressed here, and I believe that their proper application would result in a simple, practical method of positive identification of any individual 100 khz harmonic heard on a receiver. I have not tested this system, however, mainly because I do not yet have a frequency counter. I don't think any great problems would be encountered, except possibly in the stability of the calibrator oscillators.

. . . K5LLI

References: (1) Ashe, "100 khz Thin-Line Pulse Generator," 73, February, 1968, p. 24. (2) Jones, "An Integrated Circuit Electronic Counter," 73, February, 1968, p. 6. (3) Suding, "A Cheap and Easy Frequency Counter," 73, November, 1967, p. 6. (4) Kiver, *Transistors in Radio and Television,* McGraw-Hill, 1956, p. 141.

Ham Tips: Save That Shielded Braid

Normally discarded shielded braid can be used as both a soldering aid and a heat sink. To utilize the braid as a soldering aid, dip the tip of the braid into some rosin flux. When desoldering components, heat them first and then touch the braid to the terminal. The mesh on the braid will act as a sponge and soak up the solder, leaving the terminal clean and solder-free.

When soldering to heat-sensitive components, use the braid minus the flux to conduct excess heat away from the component.

As the solder fills the braid, simply clip off the solder filled portion leaving fresh braid for future use.

Happy soldering!

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Adapting AM Transmitters to FM

In many parts of the country, one of the most popular bands today is two-meter FM. Most of the equipment is obsolete commercial equipment which has become available to the amateur market because changes in the standards necessitated replacement of the old wide-band gear with newer narrow band equipment. Some new FM transceivers designed especially for the amateur market are beginning to appear, but they are in the $300 range. If the amateur does not have access to obsolete commercial equipment or the inclination to adapt it to amateur frequencies, he may feel cut off from this interesting mode of operation. However, it is possible to get on the air experimentally by adapting existing AM equipment, as this article will show.

The first thing to do is to receive somebody else's signal. If you have a two-meter converter, you can do a passable job of receiving strong local FM signals by slope-tuning an AM receiver, or using an FM adapter which is available for some receivers. If you are receiving narrow-band FM, the product detector in a sideband receiver works very well.

Once you have heard something on the air, the next problem is how to talk back to it. If you have an existing two-meter AM transmitter, the likelihood is that it uses 8 mhz crystals. The easiest way to adapt this is to build a separate FM generator which produces a signal on 8 mhz and inject it at the crystal oscillator stage.

I converted one such transmitter by removing the AM modulator stages, and utilizing the sockets which were there to make a three tube FM generator. The diagram and parts values are shown in **Fig. 1**.Two 6SL7 tubes and one 6SG7 are used. These were selected simply because the octal sockets were already in the chassis. More modern equivalents can be substituted and only very slight modifications in parts values may be required thereby.

One 6SL7 serves as a high gain voltage amplifier for a high impedence microphone. There is nothing very special about this except that it has an *rf* trap in the input, which is a good feature to build into any high frequency transmitter. You may not need it, but *rf* has a nasty way of getting into the grid of the first tube without it.

The other 6SL7 serves as a Pierce oscillator and a PM modulator. You will note that there are two variable capacitors in the crystal oscillator circuit. The 25 pf capacitor is a vernier frequency adjustment for bringing the crystal exactly to the right spot. The 100 pf capacitor controls feedback. The two capacitors interact somewhat, and the feedback capacitor can actually be replaced in most cases with a small fixed mica of 20 to 50 pf, but if you put the variable in to begin with, you have the advantage of adjusting for optimum output even with a balky crystal. This may prove to be important, especially if you have to doctor the crystal onto frequency yourself.

Divide the desired output frequency by 36, which will place the crystal in the four megacycle range (146,940/36 = 4081.666). You can order a crystal with reasonable tolerance from a number of the firms who specialize in regrinding surplus crystals. The crystal I obtained proved finally to be slightly too high in frequency to net with other stations on the air. The 25 pf condenser was not sufficient to bring it all the way to frequency, so I used one of the old ham tricks. I opened the crystal holder and carefully drew a 1/8 inch circle with a lead pencil right in the middle of one side of the plate. Upon reassembly, this proved to have moved the crystal just enough so that the APC padder would pull it precisely zero beat with other stations on the air. I found a 20 pf fixed capacitor suitable for the feedback circuit, although some crystals and tubes might require as much as 100. Obviously, a crystal oven would be better than a "raw" crystal, if it is available.

The second half of this 6SL7 tube is a PM

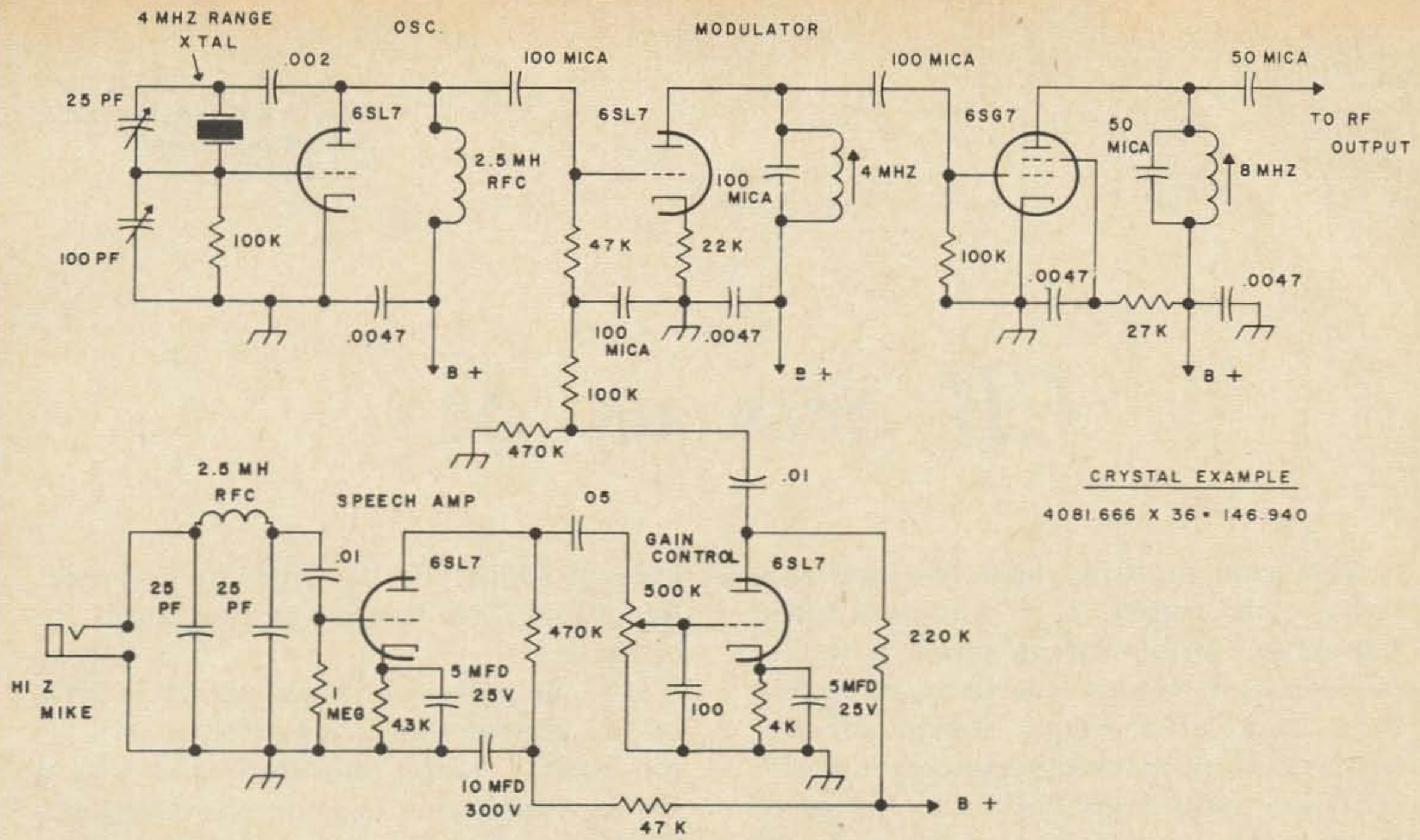

Fig. 1. Simplified 8 mhz FM generator and crystal substitute.

modulator. Do not bypass the 22K resistor in the cathode as this degeneration is important to the operation of this stage. I will not detail how this particular modulator works except to note that it produces almost as much amplitude modulation as phase modulation. The amplitude modulation disappears after the signal is passed through a number of saturated stages, which is one way of describing the hard driven multiplier stages in the typical transmitter which has to multiply a fundamental signal 36 times to get on the frequency. You can check with the sensitive *rf* meter at various stages along the line to observe decrement in the existing amplitude modulation. By the time you get to the final, there should be none at all.

This does require that the first amplifier after the modulator be a very sensitive high gain stage. I found a 6SG7 to be a very suitable tube for this purpose. Any number of miniature tubes will serve as well. The only thing you might need to change is the screen grid dropping resistor, which should be adjusted to provide the proper screen grid voltage as indicated in tube charts. One further question remains and must be left open to experimentation and to the taste of the operator. This is the question of audio frequency response. PM tends to sound tinny and some roll off of high frequencies in the transmitter or receiver is required to give a more pleasing sound. This can be most easily accomplished by shunting the grids and/or plates of the 6SL7 speech stages to ground with various size capacitors until you get the sound you want.

Obviously, this simple equipment is not likely to give you the best signal on the band, but then you haven't invested much in it either. If this mode of operation intrigues you and you want to carry experimentation further, the next thing I would recommend is a clipping or compressing circuit in the speech stages. This will help maintain a higher average deviation while restricting the peak deviation. This serves the same basic purpose as ALC in a side band transmitter or clipping and compressing in an AM transmitter, namely that it keeps the apparent percentage of modulation at the receiver high despite a wide variation in the actual level of sound input at the microphone. Again, just as with speech treatment in these other modes, excessive compression or clipping will distort the sound patterns enough to give the transmitter a very artificial sound. Taste and judgement are required, and for this, you need a good friend on the air who can give you a technically competent and honest report. This may be the hardest part of the whole operation to come by, but the FM fraternity is still new enough to include a great many experimenters, and you can probably find a sympathetic critic in your area if you look for one.

. . . WA4UZM

Rob McKnight WB2FHW
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Buffalo, NY

CB Sets on Six

The band primarily used for local contacts is six meters. It is uncrowded and transmitters with very low power as well as receivers with modest selectivity are widely used. Lack of a simple station for six, however, keeps many otherwise enthusiastic operators away from this band. Having to build a converter for the station's present receiver, and an entirely separate transmitter for six is not very appealing to many operators. This article has the answer to their problem. Its subject is the conversion of the ordinary, everyday CB set to six-meter operation. Several advantages make it worthwhile: 1. the set already has the basic transmitter and receiver circuits and thus is easy to convert; 2. its transceiver type of operation is convenient to local contacts; and 3. it would make an ideal local vhf net monitor. If you were a CB'er turned ham and still had the old rig hanging around, you would have the added bonus of not having to find a CB set to convert in the first place.

The major requirement is that you obtain a CB set suitable for conversion. By suitable I mean that it should be a tube type rig and not a transistor one. Transistors in the receiver work at 27 mhz, but they may not work at 50 mhz. You would save yourself a lot of trouble by working with tubes. As far as test equipment goes, a vtvm and a grid dip meter are very helpful.

Conversion

The receiver section of the transceiver is converted in the following manner:

1. Tune into the CB band, tune up the *if* cans, and get the set working satisfactorily.

2. Resonate the *rf* and mixer coils to 50 mhz with the grid dip meter. Since the oscillator usually runs above the *if* frequency, adjust the oscillator to its proper frequency. The receiver is now ready to operate.

3. Tune up a signal on six meters. In place of the present tuning capacitor, if it tunes too great a range, substitute one with a smaller capacitance or remove several plates from the one in the set to give less frequency range. This, however, may not be desired, as one may wish to receive, for example, a MARS frequency, in which case he would rather leave the original tuning capacitor untouched. This finishes the receiver conversion.

The transmitter section of the transceiver is converted as follows:

There are two ways to convert the transmitter:

1. Leave the original oscillator in the circuit and resonate its output coil to 50 mhz. Insert a 50 mhz overtone crystal in the oscillator and you're finished. Overtone crystals, however, are more expensive than 8 mhz ones, and are usually not used in today's six meter rigs. On the other hand, use of an overtone crystal requires one less stage in the completed rig.

2. The second method of conversion and probably the most widely used is the use of an 8 mhz oscillator-tripler stage and a doubler stage. Refer to the circuit diagram for details. *Important:* Be careful not to leave out any bypass capacitors or any B+ decoupling resistors, otherwise the unit may fail to oscillate, or a stage may not work properly. An extra tube is required in this circuit, that being the doubler stage, which, as indicated, can be a section of a 12AX7 or a section of a 6U8. In addition L4 should be wound inside of L3 for good coupling. The

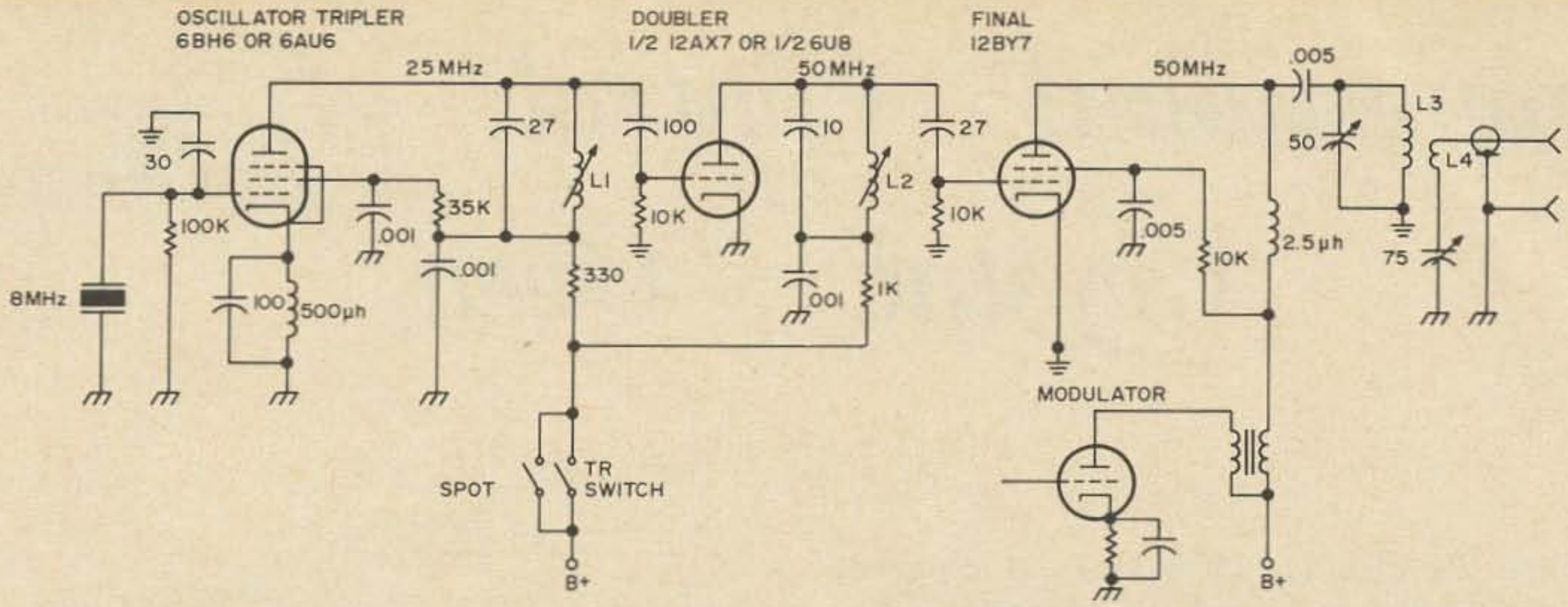


Fig. 1. Circuit diagram of the converter transmitter using the 8 mhz oscillator-tripler and the doubler stage. Coils L1, L3, L4 were already in the set. L2 was obtained from an old TV chassis. This circuit diagram may seem a bit incomplete, but since every CB set is different, the circuit must be broad enough to cover all models. As a result, some experimentation will be necessary to determine the proper coils to be used.

transmitter conversion is now complete.

Tune Up

Procedure: 1. Hook a No. 47 pilot lamp on the antenna jack or terminals.

2. Set each coil for the approximate frequency indicated on the circuit diagram.

3. Make sure the oscillator is functioning properly. This can be determined by listening to the signal in a nearby receiver. If there is a spot switch on the set it can be used to listen to the oscillator in the transceiver's receiver.

4. Put the *rf* probe of the vtvm on the grid of the doubler stage, and tune L1 for maximum *rf* indication on the meter (maximum pointer deflection). If an *rf* probe is not available, put one end of a 1N34 or an equivalent diode on the end of the vtvm's dc probe, and touch the free end of the diode to the circuit to be measured.

5. Place the *rf* probe on the grid of the final, and tune L2 for maximum *rf* indication.

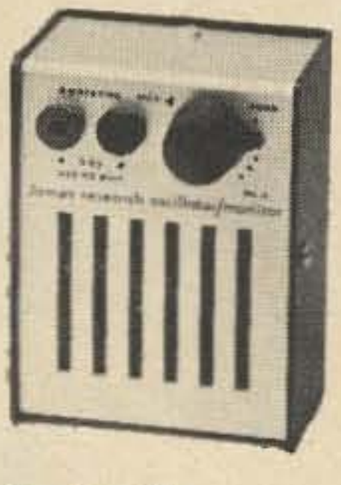
6. Place the loading capacitor at minimum capacitance, and tune the plate tuning capacitor for maximum brilliance of the No. 47 pilot lamp previously hooked up. Increase the loading by increasing the capacitance of the loading capacitor, and then dip the current using the plate tuning capacitor.

7. If an overtone crystal is used instead of the 8 mhz oscillator-tripler, the transmitter should be tuned by resonating the oscillator plate coil to 50 mhz. The rest of the tuning is done as described above.

You now have a complete low power station for six meters. All that remains to be done is to hook up the antenna and a mike. I might add that there is really no need to have to switch the beam from the big six meter rig, that is if you have one; the set got out quite well on a simple dipole mounted on a stick of board. The total cost of converting the rig was nothing, as all the necessary extra parts were available from the shack junkbox. So if you want to have some fun on the band which is becoming more popular every day, try this simple conversion; you'll be glad you did!

. . . WB2FHW & WA2HNJ

mark 2
oscillator/monitor



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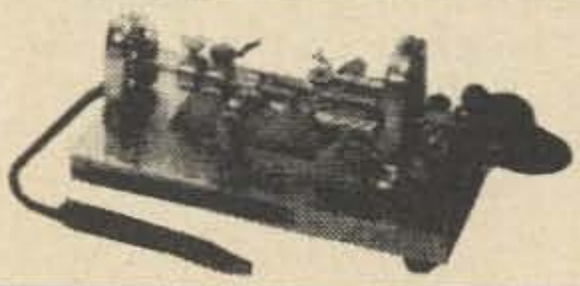

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Proportional Control Crystal Oven

Robert S. Larkin, W2CLL
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When the ultimate in stability is required in an oscillator, a temperature controlled oven must be used. Until recently, ovens took the form of a box surrounded by a heating element and containing a thermostat. When the temperature is too low the thermostat closes, causing the heating element to come on. After the temperature rises to the thermostat switching temperature the heater goes off, allowing the box to cool down. This process continues with a full cycle usually taking a few seconds. One limitation of this system is having the heater either *on* or *off*. This means that at all times there is either too little or too much heat being applied. The result is a cycling of the box temperature as the heater goes on and off.

In the course of some uhf communications experiments, where a stable frequency and time reference were required, the oven described here was built. This oven is capable of much better temperature control than the old thermostatic type of oven. Proportional control is used to allow the correct amount of heat to be applied. Once the temperature of the oven reaches the correct temperature, the heater power adjusts to some level between

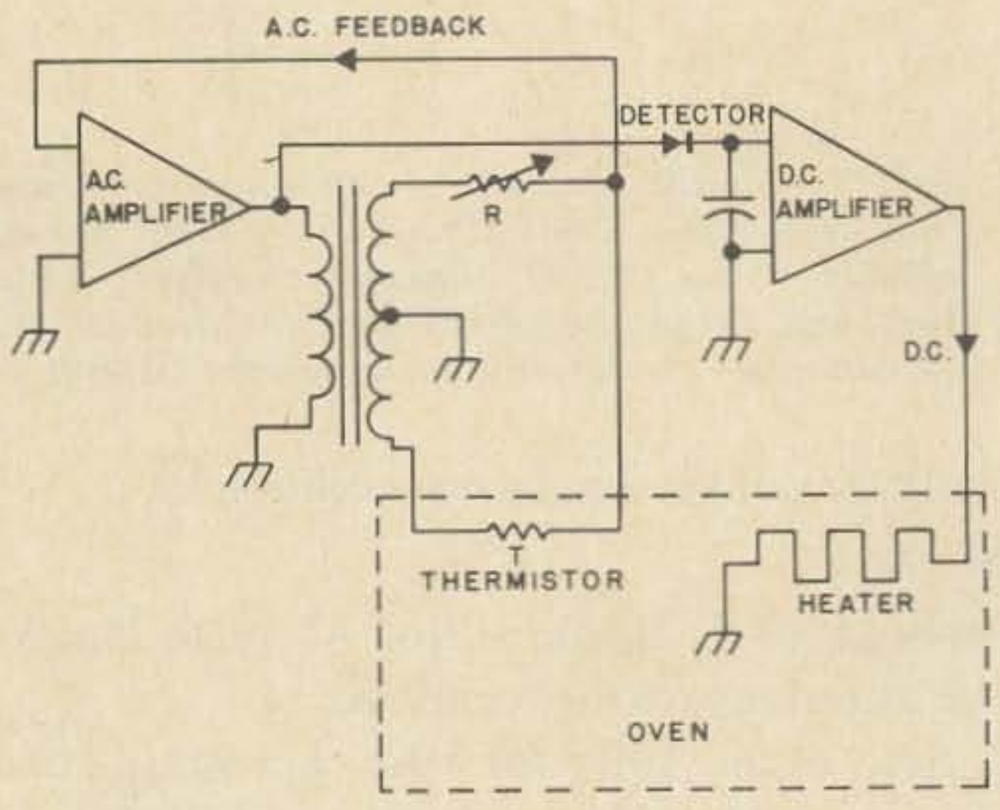
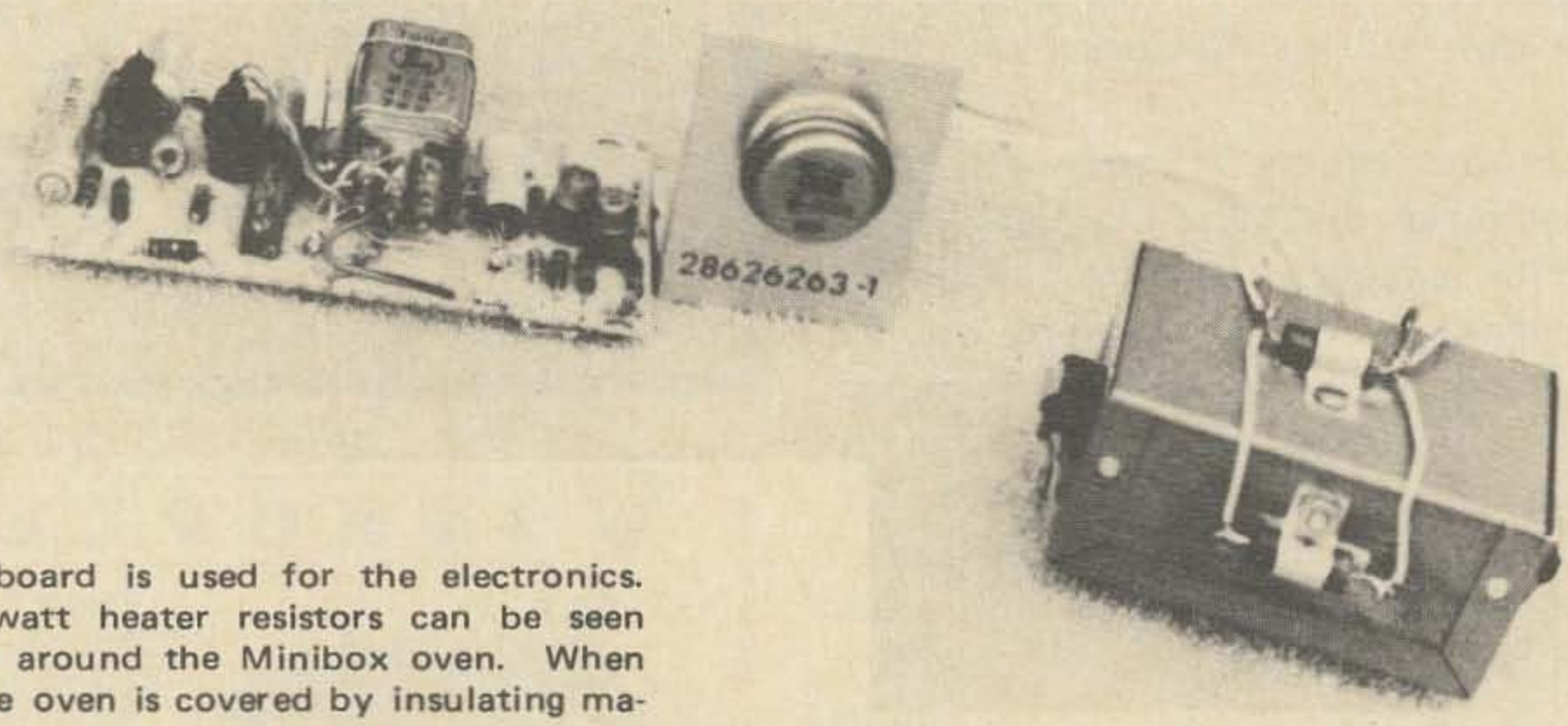


Fig. 1. Simplified diagram of oven temperature control.

all off and all on and stays there. If there is a change in the temperature outside the oven, the heater power will readjust automatically to keep the oven temperature constant. This type of oven is used in almost all precision frequency standards in commercial use today. Many ideas used in the design of this oven came from an article by W.L. Smith[1].

An interesting aspect to this type of oven is its relatively low cost. With any kind of junk box at all, this proportional oven can be built for less than the cost of a thermostatic type crystal oven.



Vector board is used for the electronics. The 2 watt heater resistors can be seen clamped around the Minibox oven. When used, the oven is covered by insulating material.

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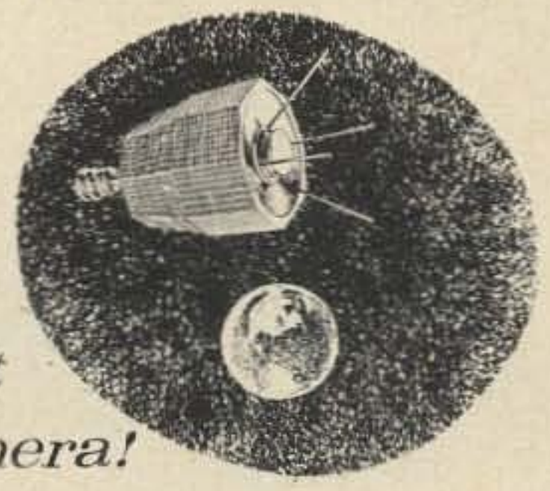

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Circuit

Operation of the oven control is best understood from the simplified diagram. The thermistor is a temperature sensitive resistor[2]. Mechanically, it is attached to the inside of the oven case. Electrically, a bridge circuit is formed so when the resistance of the thermistor is equal to that of resistor R, no voltage is fed back to the input of the ac amplifier. When the thermistor is cooled, its resistance increases. By choosing the correct phasing of the transformer windings, this will cause positive feedback around the ac ampli-

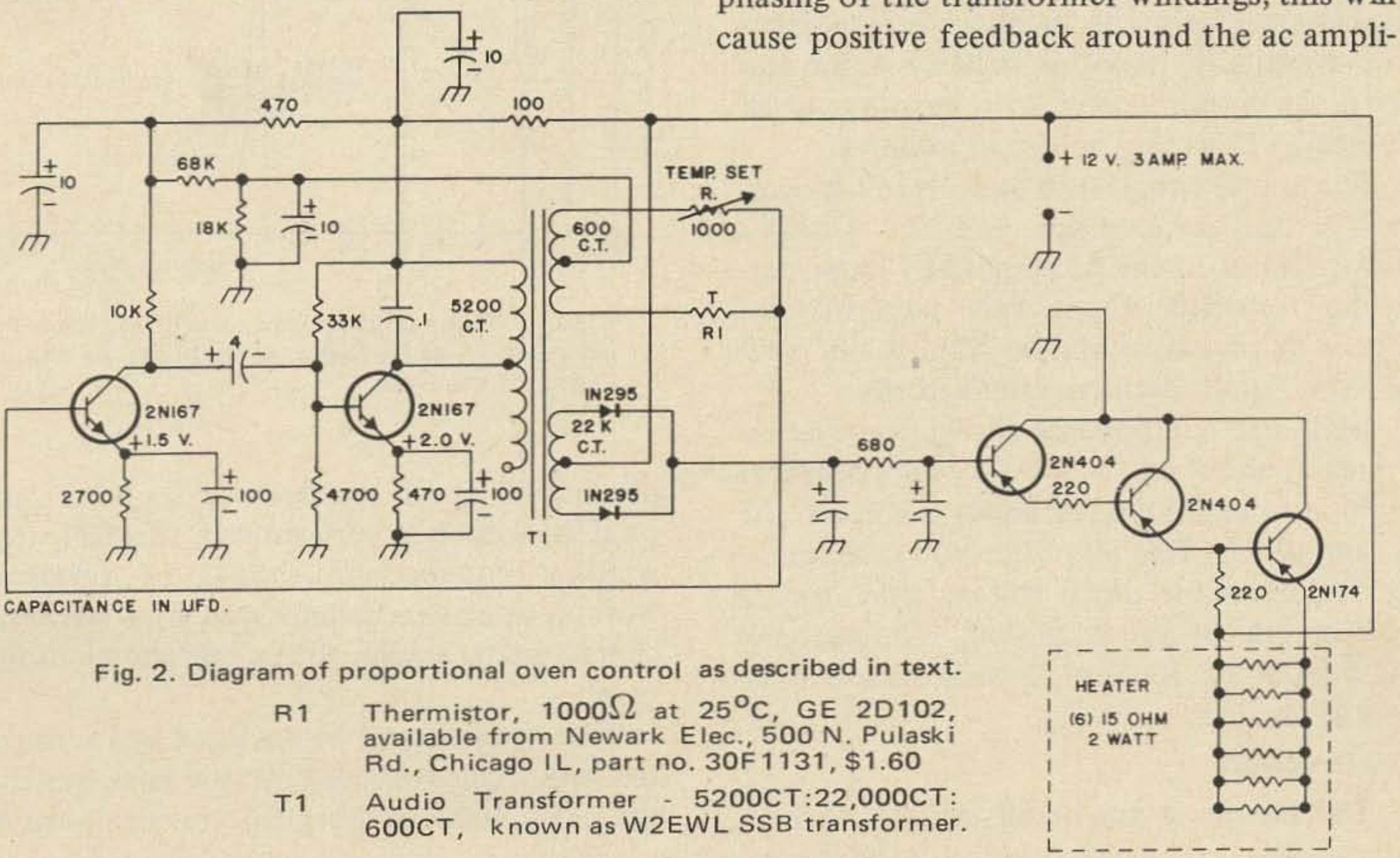
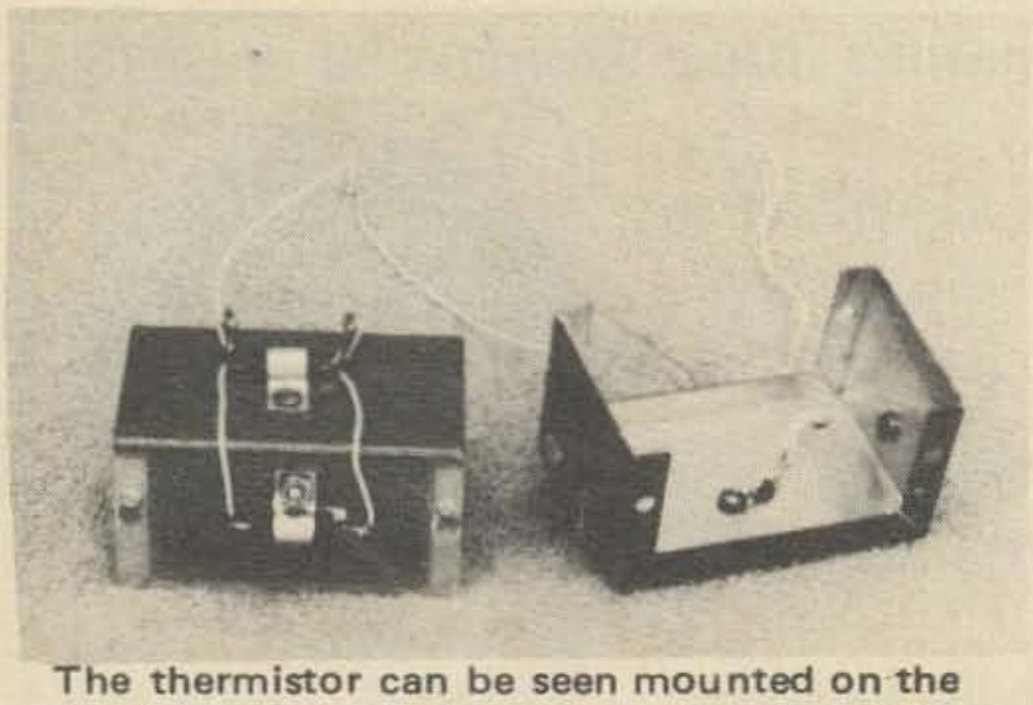


Fig. 2. Diagram of proportional oven control as described in text.

R1 Thermistor, 1000Ω at 25°C, GE 2D102, available from Newark Elec., 500 N. Pulaski Rd., Chicago IL, part no. 30F1131, $1.60

T1 Audio Transformer - 5200CT:22,000CT: 600CT, known as W2EWL SSB transformer.



The thermistor can be seen mounted on the inside of the Minibox oven. Paint was removed from the box where the resistors are mounted. An unpainted box would be preferable.

fier creating an audio oscillator. The voltage level from the oscillator is converted to a dc voltage by the detector. A dc amplifier raises the power level to a maximum of about 25 watts to drive the oven heater. As the heater warms the oven and the thermistor, the bridge is brought back to balance by the lowering of the thermistor resistance. If the thermistor resistance is lower than that of R, negative feedback occurs around the ac amplifier and no oscillation will exist. In this way, power is applied to the heater only when the temperature of the oven case is less than the desired temperature.

Between the point of no oscillation of the ac amplifier and full clipped oscillation, there is some voltage level that allows the heater to supply exactly the heat lost from the oven. Rather amazingly, this feedback arrangement will eventually find this balance point and bring the heater power to a constant level. Typically, this takes about 30 minutes.

The actual circuit uses two 2N167 transistors in the ac amplifier, and two 2N404's and a 2N174 in the dc amplifier. These particular transistor types were used because they were readily available. Almost any similar type should perform satisfactorily.

With the components shown, oscillation occurs at about 800 hz. A full wave detector provides a maximum of about 8 volts to the dc amplifier. This amplifier uses three emitter followers for unity voltage gain, with a current gain of about 20,000. The heater is built from six 15 ohm, 2 watt carbon resistors in parallel.

Construction

The layout is not at all critical. A heat sink of about 8 square inches area was used on the 2N174.

A standard 2-3/4"x2-1/8"x1-5/8" Minibox (Bud CU 3000 A) forms the walls of the oven. A 15 ohm 2 watt resistor is fastened by a cable clamp on each of the six sides. To provide good thermal contact, the side of each resistor is filed flat to a width of about 1/8". Transistor heat sink thermal compound is applied between the resistor and the Minibox. All six resistors are wired in parallel to form the heater.

In order to minimize the time required for the thermistor to sense the heater temperature, the thermistor is mounted inside the box behind one of the resistors. This gives a thermal lag of about 30 seconds and allows a reasonable warm-up time for the oven. The thermistor is carefully soldered to a ground lug that is then electrically insulated from the side of the oven by a mica washer. Again, heat sink compound is used to increase the thermal conductivity.

Operation

The only initial adjustment required is the phasing of T1. If oscillation does not occur, or if operation is very erratic, the 600 ohm winding connections should be reversed. Normal operation is indicated by a warm-up characteristic similar to the one shown in the graph.

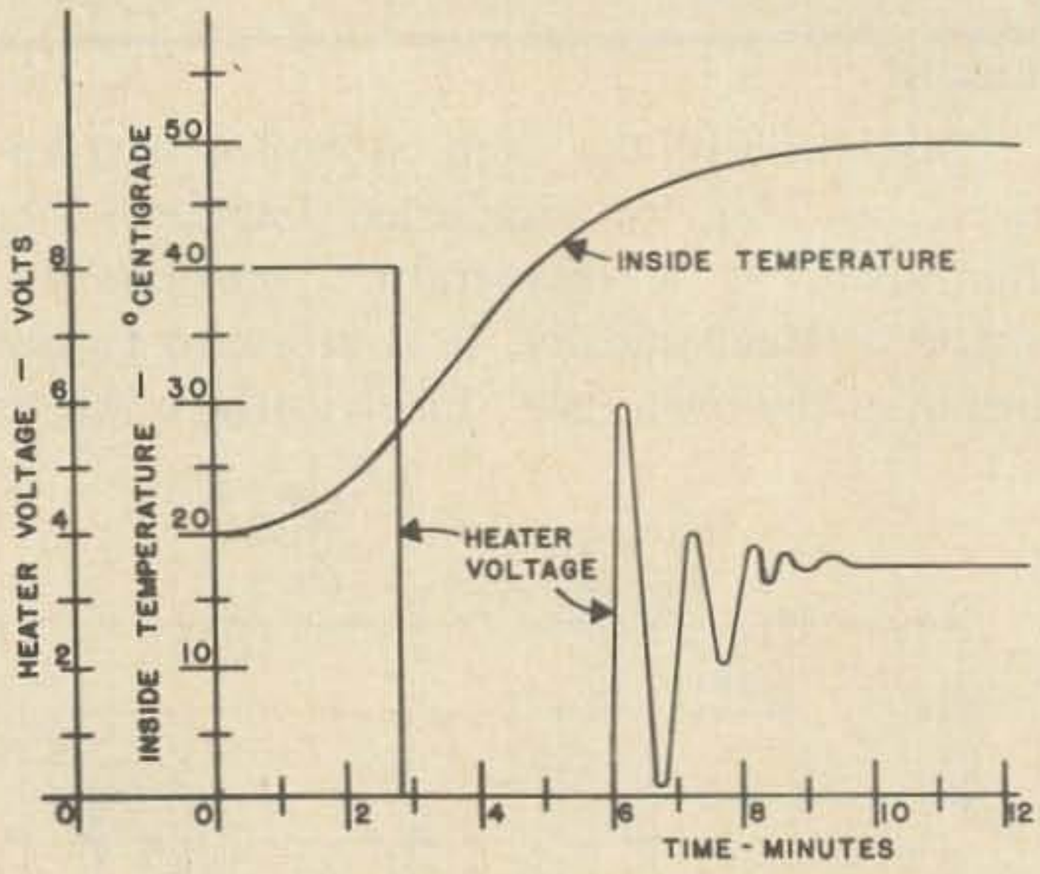


Fig. 3. Oven warm-up characteristics. Temperature measurements were made at the center of the oven.

The oven should be enclosed in an insulated box. This reduces both the heat loss and the magnitude of harmful transient events

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such as cold breezes. A 1" to 2" layer of foam rubber or fiberglass is adequate insulation around the oven.

The contents of the oven should not touch the walls. Components inside the oven are best mounted by a thermal insulator such as foam rubber.

By adjusting R, the temperature in the oven can be set to almost any temperature above the ambient. The maximum temperature attainable is limited by the 25 watts deliverable to the oven. If the oven is well insulated from the air this can mean temperatures over 100° C so be careful or you may melt your new precision standard! Even above about 75° C some components may deteriorate. The oven takes about 30 minutes for the insides to warm up to a constant temperature. As shown in the graph, the heater power steadies up in about 10 minutes after having considerable overshoot.

...W2CLL

Bibliography:

1. W. L. Smith, "Miniature Transistorized Crystal-Controlled Precision Oscillators," IRE Transactions on Instrumentation, September 1960.
2. C. K. Klinert, "The Thermistor," 73 Magazine, November 1968, p. 78.

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A Crystal Filter
Phasing Control

"They can make friends enemies, and enemies friends, by philters," *The Anatomy of Melancholy*, Burton, 1621.

Yes, even back in the 1600s, it seems they were using filters . . . er, philters, that is . . . to perform useful feats of magic. And what better legerdemain can be found in the modern communications receiver than a crystal philter . . . filter, I mean.

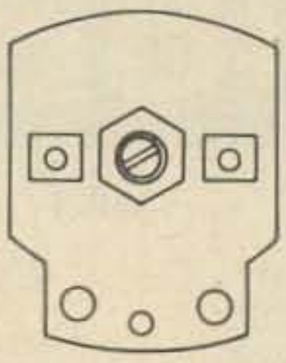

Fig. 1. Front view of the unmodified capacitor.

A crystal filter is useful in improving receiver selectivity because of its ability to pass one frequency while attenuating all others. It has another useful attribute as well – its ability to null out a specific frequency near the acceptance frequency. The use of a phasing control permits the null frequency to be varied slightly so that a near-by interfering signal can be eliminated without unpeaking the desired signal.

Although the control described was used in the "Second Chance" circuit,* it can be used in just about any standard *if* crystal filter circuit with untuned grid. The phasing control, which is simply a three-plate variable capacitor, is mounted and wired in place of the rotary "crystal on-off" switch on the front panel of the BC-348. The problem is – try to find a small variable with an insulated rotor shaft in any of the parts catalogs! After much looking, we became convinced that the only way we could get what we needed was to make one. The victim was a small APC variable capacitor with a short slotted shaft and locknut. These have been a drug on the surplus market for years and can be found very cheap. Figs. 1 – 4 show details of the modification.

Surgery is performed as follows:

a. Remove and discard the locknut. Next, with a knife blade or slender screwdriver, spread the four slotted parts of the shaft bushing apart and bend them away from the shaft. Flex them back and forth until they snap off.

b. Remove the collar from the tip of the shaft by filing a slot in the collar. It is mounted on the shaft with a force fit and can easily be pushed off once it has been weakened by filing.

c. Position the shaft so that the plates are

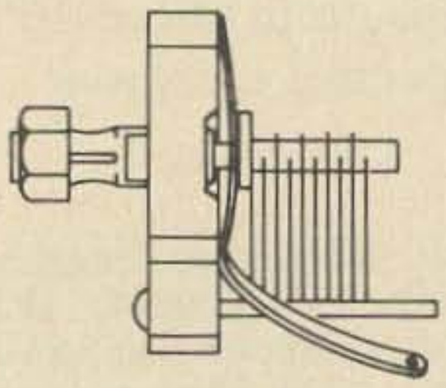

Fig. 2. Side view of the unmodified capacitor.

*"A Second Chance Crystal Filter for the BC-348", 73, June, 1966.

disengaged. Then withdraw the rotor assembly, taking care not to bend the three-legged flat shaft spring (one leg is the rotor connection terminal lug). File the rough surfaces of the shaft bushing on the front of the capacitor until the bushing presents a smooth bearing surface. Remove all but the two stator plates and the one rotor plate nearest the ceramic body of the capacitor by gently bending the plates back and forth until the soldered joint fractures. File or clip off the excess portion of the stator plate support pins and the rotor shaft.

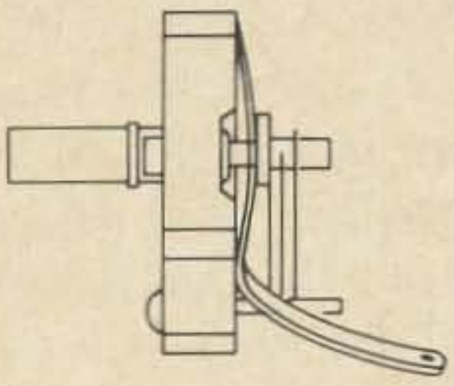

Fig. 3. Side view of the modified capacitor.

d. Prepare an insulating sleeve that can be forced over the rotor shaft to receive the tuning knob. The sleeve must be 1/4" in diameter and can be about 1/2" in length. We used a plastic test prod handle, cut to length, that merely needed enlargement of the bore down the middle. A No. 21 drill makes a hole that fits snugly over the metal rotor shaft. The tight fit is important because the sleeve must be forced on in such a way that the rotor contact spring is compressed and the proper spacing between the plates is maintained. Incidentally, the rotor spring may be flattened a bit to relieve some of the pressure it exerts. It need only make good electrical contact against the shaft shoulder when the plates are properly spaced. A small metal washer is used between the bearing end of the plastic sleeve and the filed surface of the bushing to prevent abrasion of the sleeve. To assemble, place the rotor contact spring in position, insert the rotor shaft through the spring and bushing, add the metal washer over the shaft, and force the plastic sleeve over the rotor shaft until the plates are properly spaced, noting that the spring is slightly compressed and making good contact with the rotor shaft. This completes the capacitor modification.

The phasing capacitor is mounted on the panel in place of the "crystal on-off" rotary switch. The original knob is re-used and

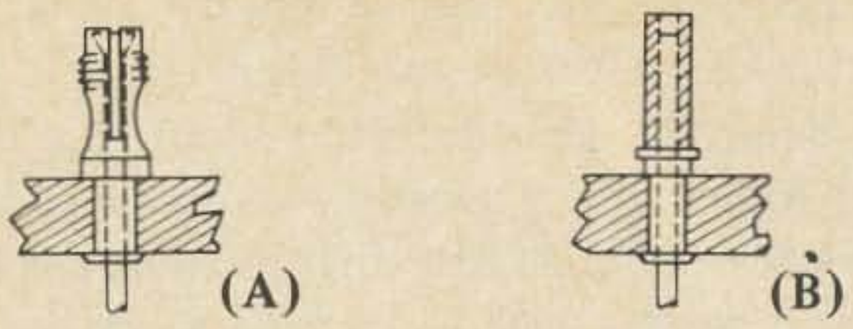

Fig. 4. Shaft details; (a) before modification, (b) after modification.

covers the two machine screw heads holding the capacitor in place. A small piece of black plastic tape may be placed on the back of the panel to cover the small hole which the switch anti-rotation lug occupied.

By bending one corner of the rotor plate, the capacitor will short-circuit itself when the plates are fully meshed. This will disable the crystal filter and provide normal low-selectivity reception.

One word of caution on connecting the phasing capacitor across the crystal – be sure you connect the grid side of the crystal to the stator. We inadvertently connected it the other way first and heard a beat note every time we touched the metal knob. It turned out that a local BC station, only a khz away from the *if* frequency, was getting into the *if* amplifier through the shaft insulation capacitance, tiny as it is! Reversing the connections cured this.

To understand how the filter is able to perform this dual role, a small dose of theory may be helpful. First of all, it is important to accept the fact that a quartz crystal has *two* resonant frequencies. One is the series-resonant frequency, at which the crystal offers almost zero impedance; the other, about 1 khz higher, is the parallel-resonant frequency, at which the impedance is very high. The variation of impedance as a function of frequency is shown in *Fig. 5.* At the series-resonant frequency, the crystal acts like a series-connected coil and capacitor. L-C combinations like this are useful as wave-traps to short-circuit undesired fre-

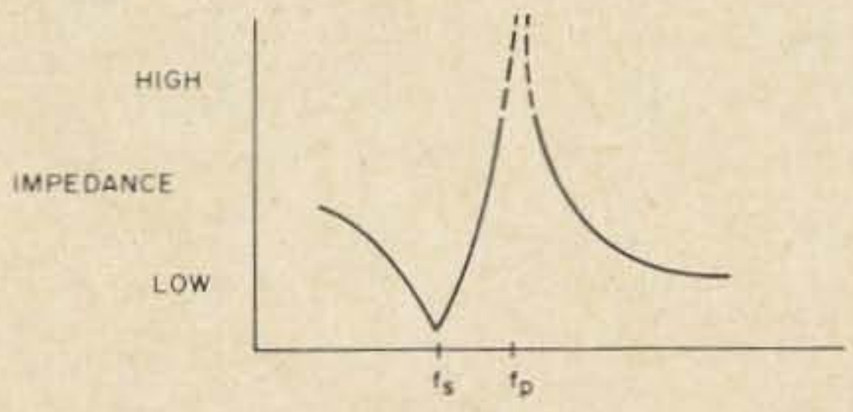

Fig. 5. The variation of impedance as a function of frequency.

quencies in the output circuit of a transmitter or in the input circuit of a receiver, for example. On the other hand, the crystal also looks like a parallel-connected coil and capacitor at a slightly higher frequency. The crystal in the grid circuit of a conventional crystal oscillator stage makes use of this configuration. Almost everyone is familiar with the fact that the frequency of a crystal oscillator can be lowered slightly by shunting a small trimmer capacitor across the crystal . . . a point to keep in mind.

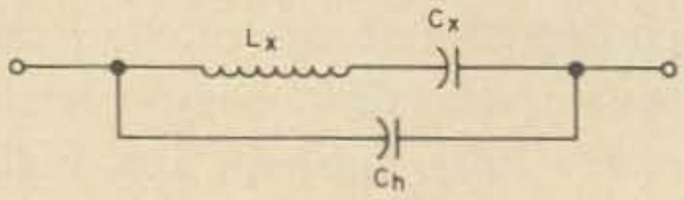

Fig. 6. The equivalent "black box" electrical circuit.

How can the crystal do two things at once? Let's take a look at **Fig. 6** which shows the equivalent "black box" electrical circuit. It is clear that Cx and Lx are arranged in a series circuit. However, Ch, representing the capacitance of the holder and wiring, is shunted across Cx and Lx.

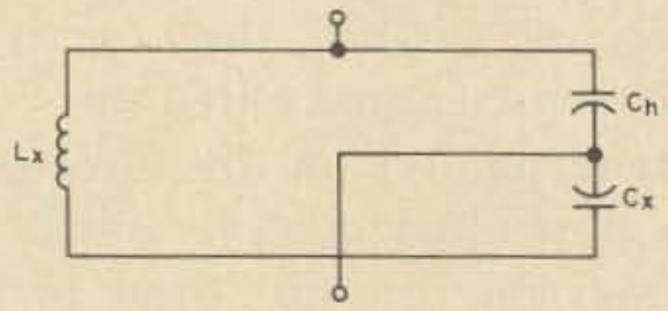

Fig. 7. The parallel resonant combination.

Redrawing it, as shown in **Fig. 7**, reveals the parallel-resonant combination. Considering the series-resonant condition, the presence of Ch has little effect on the resonant frequency; all it does is to act as an insignificant by-pass capacitor. However, in the parallel-resonant mode, Ch exerts a definite effect on frequency. If the value of Ch is increased slightly, the parallel-resonant frequency of the crystal will be lowered slightly.

In the conventional *if* bridge filter circuit, shown in **Fig. 8**, the phasing capacitor, Cp is adjusted to balance out the holder capacity Ch so the crystal will pass only frequencies at which it is series-resonant. Cp can be varied slightly either way from the balanced condition to indirectly affect the parallel resonant frequency of the crystal. Another way of doing this, especially in the BC-348 receiver, is to connect a small variable capacitor, Ca, directly across the crystal to permit small increments of the holder capacity as shown in **Fig. 9.** If trimmer Cp is set to balance out the holder capacity plus, let's say, half of Ca, then any change in Ca will cause Cp to have a surplus or deficiency of capacity as far as balance is concerned – exactly the same effect as if Cp was the variable control.

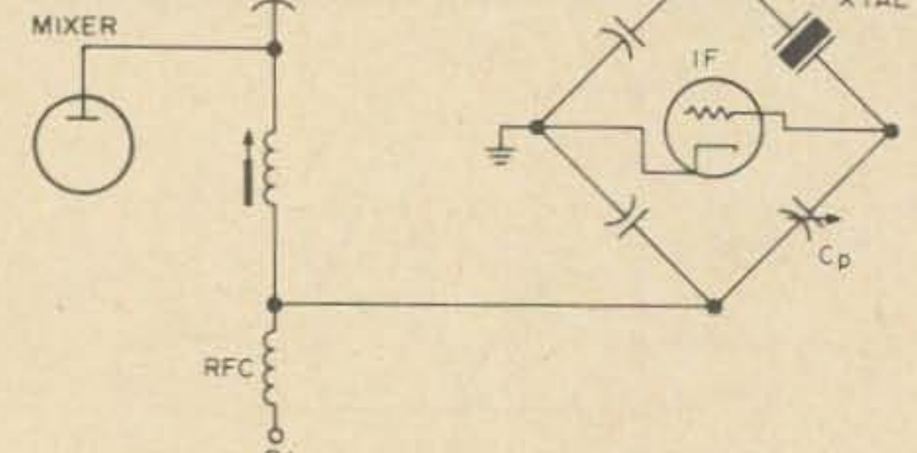

Fig. 8. Conventional bridge circuit with the phasing capacitor adjusted to balance out the holder capacity.

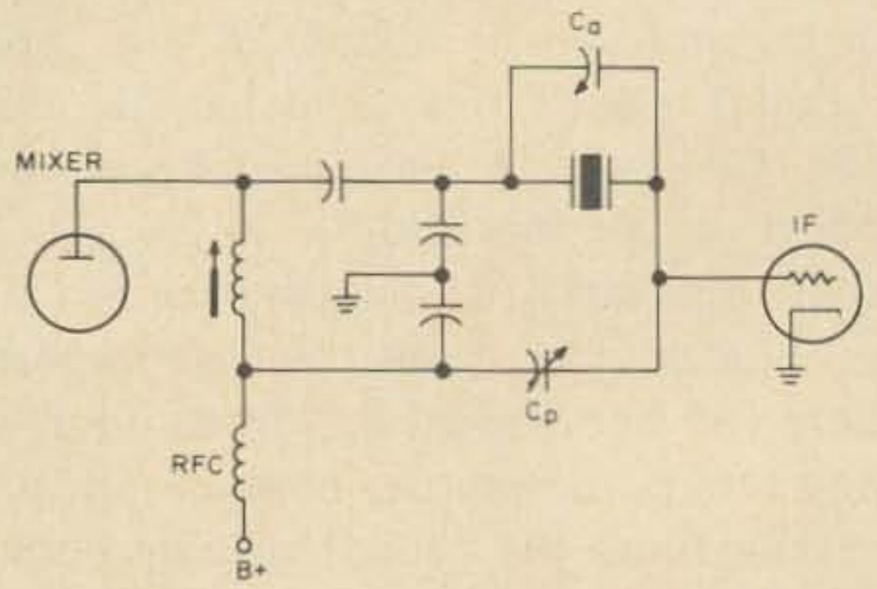

Fig. 9. A small variable capacitor is connected directly across the crystal to permit small increments of the holder capacity.

A word about *if* alignment is in order. The BC-348 selectivity curve with the filter out is as wide as the proverbial barn door. To make things worse, the *if* transformers are slightly overcoupled, making for a double-humped response curve. Originally, we felt pangs of sympathy for the designer who had to accommodate both the beacon band and the hf bands, with the result that the *if* landed in the bc band. But to deliberately broaden the selectivity that much! No doubt the military wanted a receiver that stood a chance of getting the message through when tuned roughly to a spot frequency.

The rough alignment can be made on background noise. With the bfo on and the

crystal filter in, advance the phasing condenser until it is half meshed. Then adjust the trimmer Cp until the noise has a tinny, ringing sound. Then peak up the *if* transformers (top and bottom) for the loudest noise with this characteristic sound. This completes the rough adjustment.

For the final *if* alignment, you will need a stable signal generator, preferably one that can be modulated. We found that the venerable BC-221-AK is perfect for the job. Also, you will need an ac voltmeter (say 0-5V) that can be bridged across the audio output as a tuning indicator. The object of the exercise is to find the exact series resonant frequency of the crystal. After this has been determined, the signal generator is parked on this frequency, and the final adjustment of all *if* transformers is made.

Couple the signal generator to the mixer grid through a gimmick condenser made by twisting two pieces of insulated wire together so they overlap for about one or two inches. The end of one wire can be stripped and wrapped around pin 5 of the 6SA7 mixer tube which is then replaced in its socket. Tune the signal generator slowly through 915 khz (with the modulation on and the bfo off) and carefully adjust the frequency for a maximum on the audio output meter. If you have hit it on the nose, the phasing control can be varied ±10 degrees rotation without appreciably affecting the output. Peak up the *if* transformers. Repeat the procedure to double check the alignment. A couple of hints: use no more coupling from the signal generator than is needed for a good output indication so the *if* chain won't be overloaded; also, short the antenna binding post to the ground binding post to prevent the reception of spurious signals which may interfere with the desired signal from the generator.

Before disconnecting the alignment set-up, try testing the action of the phasing control in nulling out a weak signal near the peak frequency. Detune the signal generator about 1 khz higher than the alignment frequency. Slowly tune the phasing control until the output drops drastically. This adjustment is very critical and takes a fine touch. You should get at least 15 – 20 db attenuation as the signal drops in the rejection slot. Try other offsets from the alignment frequency; at least one setting should result in almost infinite rejection as the phasing control is tuned through it.

When operating the receiver in the "single-signal" mode, the phasing control is usually set so audio images fall in the rejection slot. That is, the bfo is set to a desired pitch that corresponds with the crystal filter peak frequency. Then, the receiver is tuned to the same pitch on the other side of zero beat. The phasing control is then adjusted to eliminate this signal (the audio image). In this way, half the potential interfering signals are automatically eliminated whenever the desired signal is tuned in on the crystal filter peak.

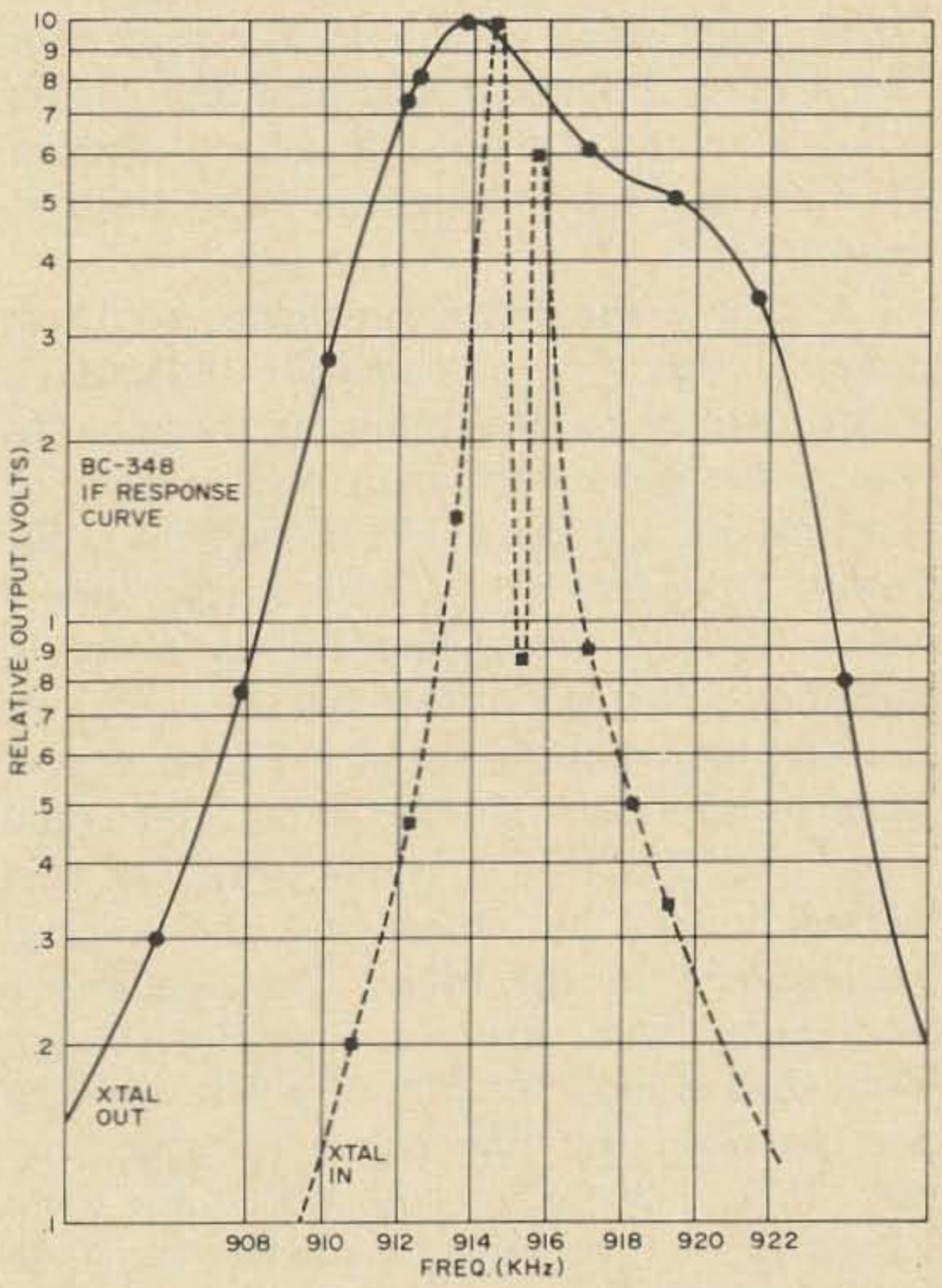

Fig. 10. The before and after if response curves.

The proof of the pudding is, of course, in the ability of the receiver to dig that rare DX out of the pile-ups. Using a homebrew converter which translates 10, 15 and 20 to the 80 meter band on the BC-348, we worked 20 new countries in two weeks. For the more scientifically inclined brethren, the "before" and "after" *if* response curves are shown in **Fig. 10.** Need we say more?

. . . W2LT

Ralph S. Yeandle, W2IK
P. O. Box 252
Schoharie, New York 12157

Grounded Grid Filament Chokes

During the course of construction of my linear amplifier employing two type 4-400 A tubes, the market price of a 30 ampere filament choke was suddenly raised from about $9 to around $25. Whether this was due to the high price of copper, the enamel on the wire, or because a beautiful doll needed a new diamond, did not interest me one iota. It was high time for ingenuity to be summoned forth.

A look at the driving impedance of those tubes in this type of operation indicated a value of 300 to 500 ohms or thereabouts, which was halved for two tubes in parallel. This meant that the choke impedance at the lowest frequency to be used should have a value of, say, five times this in order to maintain a low *rf* loss through the choke. So we are then talking about a choke impedance in the order of 1000 ohms. One could wind this kind of a choke with his eyes closed unless he considered the current requirement of the tubes. This required a very heavy wire, size No. 8 or No. 10, and even then a good fraction of a volt could be lost between the filament transformer and the tubes. When a coil takes on these proportions, there must be a better way than rolling your own.

The solution was easy. Mount the transformer on insulators at least ¼" thickness, thus isolating it from all chassis grounds. Then connect the secondary directly to the tubes using wire of sufficient size to prevent any appreciable drop in voltage to the tubes. If you find that the transformer has an electrostatic shield, as did mine, disconnect it and let it float. The secondary center tap may be connected through a choke to ground by employing one of those small multiple-Pi types, but if you are particular about getting too much dc resistance in this circuit, and about wasting a good high impedance choke where it is not needed, then here is a place where a simply constructed device can be used. One of quite adequate characteristics can be made on a 1" diameter form about 3" long, wound with about No. 30 wire. A primary choke in the 110 volt line was wound in bifilar fashion with No. 24 wire, 1" diameter and about 4½" long. The heavy capacitance existing between primary and secondary, coming about either by direct coupling or via the core, indicates that there is little difference in the magnitude of the *rf* voltage on either winding and therefore the same amount of choke impedance is needed for each. Formex insulated wire was used on the bifilar and no indication of breakdown between adjacent turns has been evident in the three years of use. If preferred, two separate line chokes may be used in the primary in which case each can be physically smaller than the bifilar. A .01 mfd by-pass is used from each side of the line to ground, on the line side only. The above dimensions are approximate and have served well in my amplifier throughout 80 to 10 meters. They were duplicated more or less for another amplifier using 2 type 813 tubes. Of course a high quality coil form may be used, but in this case the circuit impedance is sufficiently low to allow an old broomstick, hammer-handle, or a dried out sapling to be used – even at 10 meters.

So the $25 with which I almost parted was used for much more important things. Come to think of it, I believe that I bought an anti-gravity machine from a door-to-door salesman.

. . W2IK

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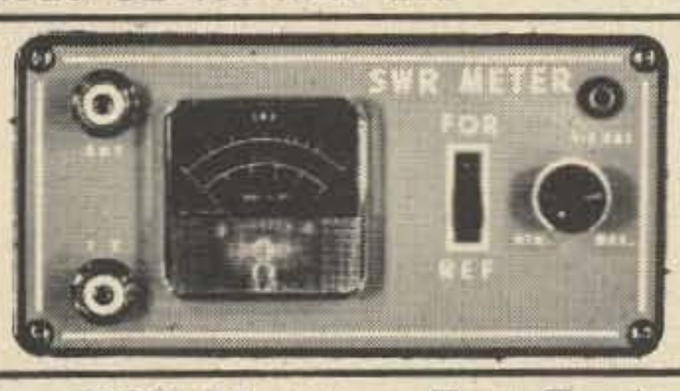

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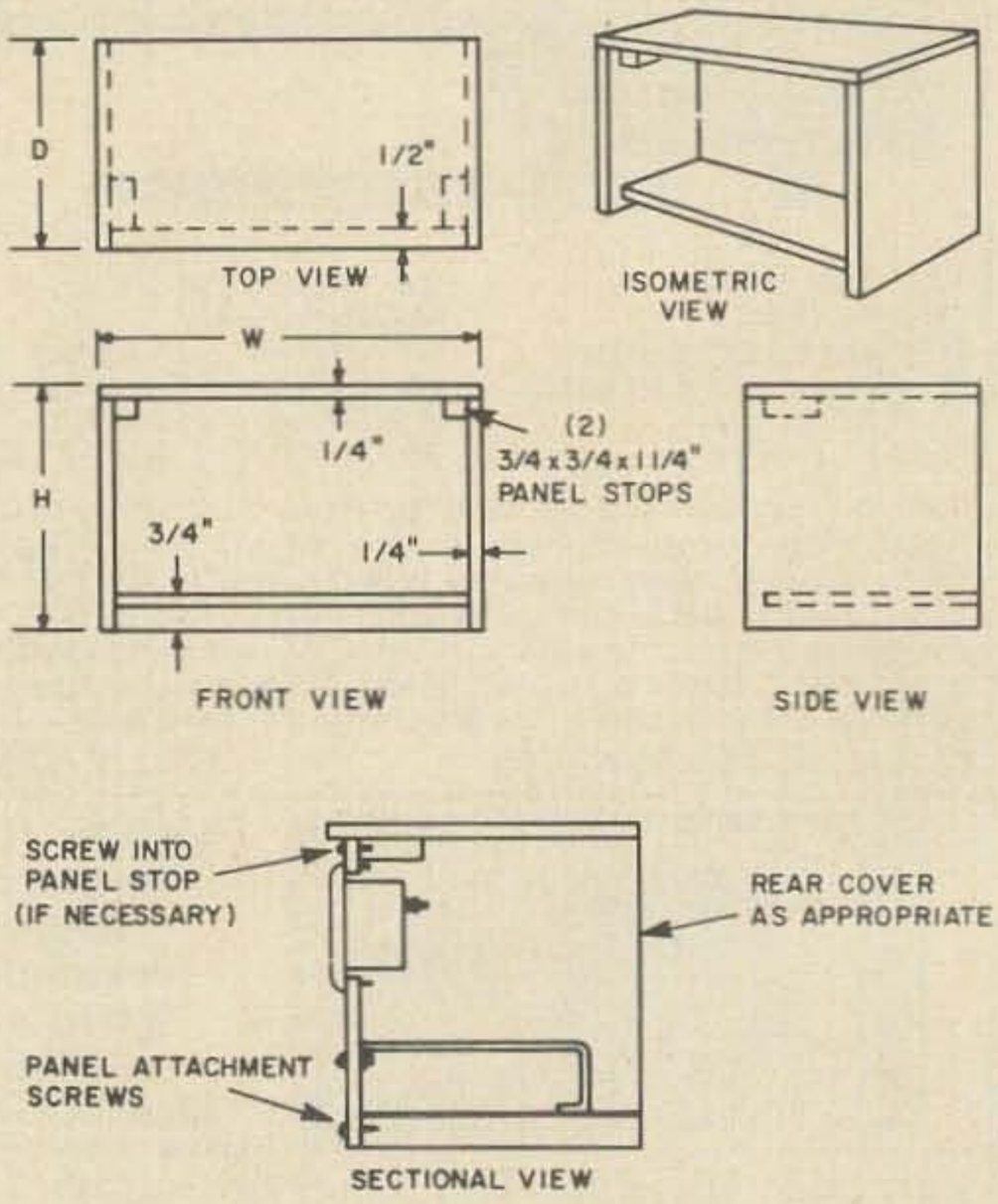
Equipment Cabinets with Style

Most experimenters and homebrew equipment builders settle for commercial cabinets, boxes and chassis to house their electronic creations. This article will describe a method of building cabinets that are simple and stylish and that can be built in a wide range of sizes. These cabinets have minimum cost and yet have the good appearance necessary to make your radio room and workshop look highly professional.

The solution to the cabinet problem is to build wooden cabinets like those shown in the photographs. Considerable development has gone into these cabinets. At this point I feel that maximum simplicity has been achieved without sacrificing utility and style.

The accompanying drawings and the text that follows describes a "type" of cabinet rather than a specific cabinet. If this type of cabinet is attractive to you, a little forethought is in order so that you may adapt the design to your own needs and to the most readily obtained materials. The width dimension will vary depending on the equipment that is to be housed. On the other-hand, perhaps you will want to standardize



on the height and depth of your cabinets so that they will present a uniform appearance. The quarter-inch plywood recommended for the sides of the cabinets will provide plenty of strength for even relatively large cabinets. However, if you have a source of another thickness or another material, it can probably be used.

Building Suggestions

The quarter-inch plywood sides and top and a three-quarter-inch pine or fir base materials appear to be an ideal combination of availability and usefulness. It is suggested that these materials be cut on a table saw if one is available. A table saw will provide square, relatively smooth edges that can be assembled without further furnishing. So little cutting is required that any friend who has a saw should be glad to make the pieces for you. Cut the sides and top from a single

piece that has been cut to the finished depth dimension. This will assure that the top and sides are all the same depth and that they will match perfectly when assembled.

The panel stops in the upper corners may be glued to the top of the sides as the first assembly step. Use white glue and half-or three-quarter-inch brads to fasten the various parts. Next, attach the sides to the base and, last, attach the top. Use the white glue generously, but wipe any excess off exposed surfaces with a damp rag. When the glue is dry – about an hour, the exposed surfaces should be sanded to eliminate any ridges between the sides and the top and to provide a smooth surface for finishing. A belt sander is handy for this operation, but hand sanding is easy and adequate.

The assembled cabinet should be sealed with shellac or a commercial sealer. It can then be spray painted using one of the quick-drying enamels or lacquers that come in spray cans. Build up three or four coats. Each individual coat should consist of several light sprays with special attention (re-sprayings) being given to any spots that tend to soak up the paint. Allow at least a half-an-hour between coats even though the label will claim that the paint "dries in minutes". The last coat should provide a high-gloss finish that will be an asset to any shelf in your house.

Nothing has been said about choosing the color for your cabinets and very little will be said. However, don't overlook the possibility of choosing one or more bright colors that will fit with your decor. I use a "mix-and-match" scheme. In the workshop, cabinets are "color coded". Power supplies are red and test instruments are black. The speaker that goes with the commercial receiver in the radio room is black like the receiver.

Panels may be metal, wood, "hardboard"

negatives for p.c. boards

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or a plastic such as Bakelite depending on the needs of the equipment to be housed in the cabinet. Hard Masonite with a couple of coats of a sealer like Firzite makes an attractive looking panel that is easily worked using wood tools.

Panels for speaker cabinets can be made from perforated metal or with openings and grill cloth in the accepted manner. The back of a cabinet may be left open; closed tightly with wood or metal; or it may be closed using perforated metal or screening. Openings in the back and sides may be provided for cooling. Heating of the cabinet top can be lessened by cementing a piece of aluminum foil to the inside of the top.

The front panel can be mounted in most cases by using three-quarter-inch round-head-wood screws through the panel into the three-quarter-inch base. The panel stops at the top will prevent the panel from being pushed in. If added security is desired, wood screws can be used in the upper panel corners. If an extra long cabinet is built, it is recommended that an additional panel stop be installed on the inside of the top at the center of the cabinet.

Uses

Cabinets of the sort described herein may be used for many types of devices.

Power Supplies
Timers
Speakers
Signal Generators
Bridges
Clocks
Chargers
Meters
Receivers
Transmitters
Standing Wave Meters
Intercoms

The list above is just a fraction of the uses that can be found. These cabinets free the equipment designer from size limitations and, at the same time, provide him with a source of easily made cabinets that will enhance the appearance of his equipment.

...W1OLP

Richard J. Zach WB2AEB
33 Pike Place, RFD-4
Mahopac, New York 10541

VHF-FM: Part I

Advantages and Practices

When you operate, what do you want in a system? You may say reliability, quality of equipment, as well as ease of operation. Perhaps you have as insatiable thirst to tinker with equipment to get the absolute best performance. VHF-FM can satisfy all these requirements and more.

As you may know, VHF-FM is growing faster than any other mode. Why has such a relatively new concept enjoyed such popularity? Perhaps we can answer this by asking still another question. What is VHF-FM? Of course, you could say that you FM a VHF transmitter. But VHF-FM (or just "FM" from now on) is also an entirely different system of communications.

About 75% of all FM activity is operated from the mobile. The rigs are surplus gear taken out of commercial service (taxis, police cars, fire trucks, etc.). When you purchase these rigs, they come with all accessories . . . transmitter, receiver, power supply, mike, speaker, control head and cables, but less crystals and antenna. They seldom run over 60 watts, with most rigs running 30 watts or under. Antenna polarization is always vertical. FM deviation is usually wide-band (±15 khz) but there are a few scattered narrow-band outfits (±5 khz). The trend today is toward narrow-band operation, though. You can get a complete rig for as little as $25, but the usual price runs between $40 and $90 when obtained from a dealer. The possibility of obtaining the used equipment directly from the commercial user should not be overlooked.

As noted, just about all FM activity is crystal controlled and hence, operates on "channels." Because of accepted channels, repeater stations can be utilized. Such repeater stations, usually located on high ground with higher power, receive signals on one frequency and simultaneously retransmit the received signal on a different frequency. Going through a repeater, you can cover a 50 mile radius using just a one watt walkie-talkie. However, in speaking with other hams, I find that there is one big misconception about FM. It seems that quite a few people think that you *must* go through a repeater. Quite to the contrary. As a matter of fact, in southeastern New York, most FM activity is "direct," without the aid of a repeater.

Another advantage of channelizing is that most stations can, and do monitor. When an FM'er gets out of work, on goes the mobile rig. When he gets home, on goes the base station. After a while, you know when the different stations are monitoring. You are now approaching the reliability of the land-line via ham radio.

Emergency communications is one of FM's strongest points. The fact that all stations are always on frequency and FM receivers are not susceptible to lightning or ignition noise provides for an extremely reliable situation. With some repeaters, if the commercial power fails, an emergency generator automatically kicks in. The abundance of mobile and portable equipment as well as the fact that much of this was designed originally for emergency use, gives FM the upper hand in most any emergency.

Operating procedure on channelized FM is somewhat unique. In some parts of the

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country, the commercial "10-code" is used. This does provide for quicker QSO's, but this aspect of operation has *not* been used to any extent in the New York City area as well as many others. "CQ" is *never* heard on FM, since there is just no need for it. All stations are on frequency, so no long call is needed.

You might simply say, "This is WB2AEB monitoring nine-four," and that's it. If anybody wants to gab, they'll answer. Since the channels are well known, when referring to them you simply say the numbers to the right of the decimal point. Thus when you refer to 146.94 mhz you say "nine-four." When referring to 52.525 mhz you say "five-two-five."

Even where six-meters AM may reign king, two-meters is often where the FM ham stays. On a national scale, two-meters is also the most popular channelized FM band. 146.94 is the national two-meter frequency with other side channels such as 146.76. The national 6-meter frequency is 52.525 mhz. There is also a national ten-meter frequency and this is 29.6 mhz. There are about 300 hams on this frequency and more are joining every day. This band is popular because the skip comes in more often than the VHF bands. To get on ten-meters FM, you simply tune the rig down to 29.6 mhz instead of 52.525 mhz. The low-band rigs tune from 25 to 50 mhz often with few modifications.

As for UHF, the ¾ meter band is popular for your own "secret" repeater. To the FM'er, six-meters is called "low-band," two-meters is called "high-band," while the ¾ meter band is called "450" or simply "UHF."

As you can see, FM *is* different.

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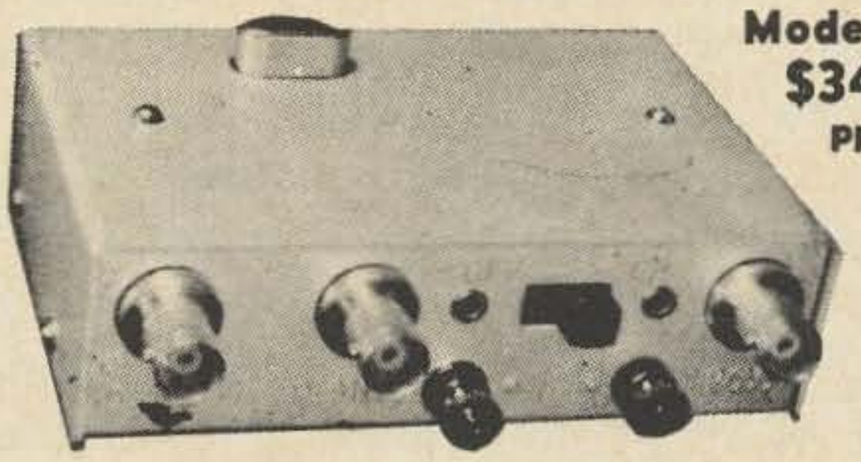

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Bring Back the Q Multiplier

Some fifteen or sixteen years ago, in another amateur publication of which Wayne Green was editor at the time, the Q-Multiplier was introduced. It immediately caught on big, and Heath began marketing a kit version which went through several models before it was recently dropped from their line. Except for its use in certain receivers as a notch filter, it has now just about gone out of style with the ham fraternity.

It's too bad that this has happened, because a Q-Multiplier can still do things no other circuit can for the same price. It is capable of a variety of functions which would otherwise require much more complicated and critical (and expensive!) circuitry. No other single circuit of such simplicity and low cost offers such a desirable combination of functions: 1. Single signal cw selectivity; 2. Tunable rejection notch; 3. Continuously variable selectivity; 4. Bandpass tuning.

How It Works

If all this sounds good to you, let's take a minute to examine the Q-Multiplier's principles of operation. Normally, more or less by tradition, the Q-Multiplier has always been set up to work with a 455 khz *if*. However, with proper modifications to the tuned circuit, it can be made to operate well at any frequency under 10 or 12 mhz.

The principle .of the Q-Multiplier is similar to a suck-out trap, but considerably more sophisticated. When used to peak a single signal, the high-Q tuned circuit in parallel with the receiver's first *if* stage is regenerative because of positive feedback. This narrows the receiver bandpass. Effectively, the triode amplifies the high Q of the tuned circuit. A signal passing through the *if* at the tuned circuit's resonant frequency sees a very high impedance, and thus passes by the Q-Multiplier more or less unaffected. A signal slightly off resonance, however, is sharply attenuated, since it sees a low impedance, and is shunted to ground.

In the notch or rejection function, negative feedback is introduced by the second

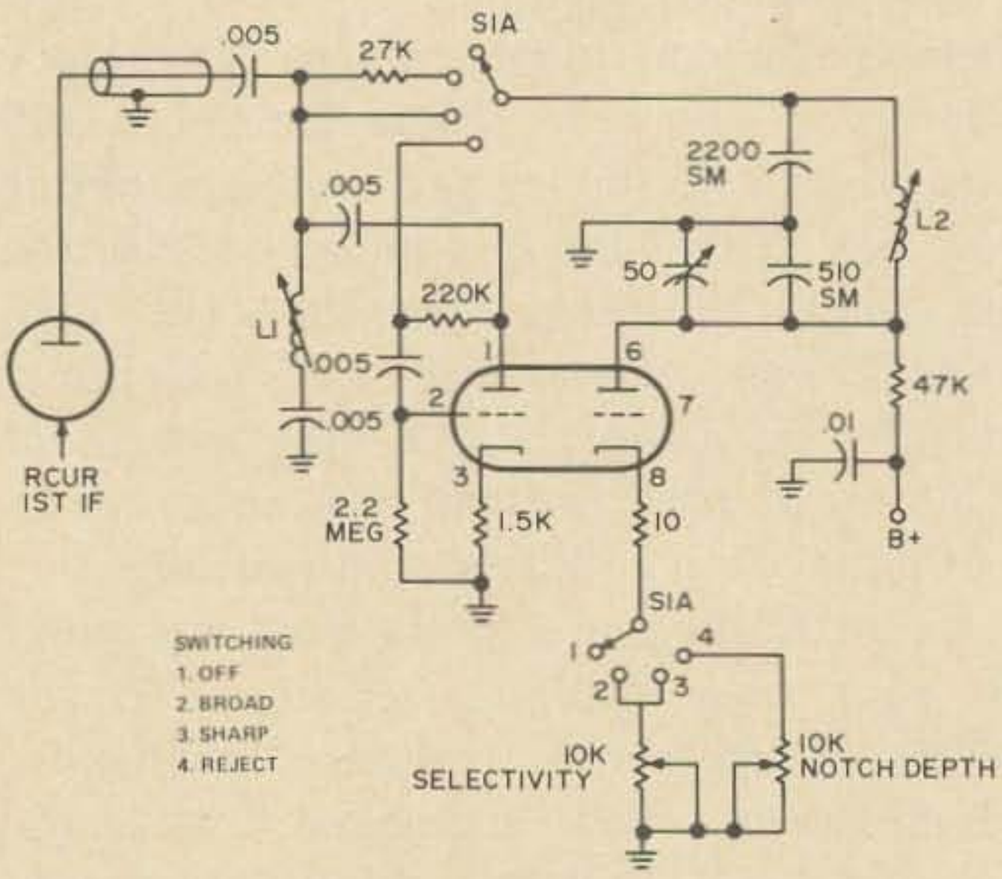


Fig. 1. The Grenell Q-multiplier. L1 & L2 can be either the Heath coils, if you rebuild, or Miller numbers 4414 and 4409 respectively.

triode, causing the impedance/frequency relationship to be reversed. Thus, a signal at the resonant frequency sees a low impedance, while those not at resonance pass through unaffected by the high impedance they see. The sole purpose of L1 is to tune out the capacitive reactance of the coaxial cable used to connect the Q-Multiplier to the receiver *if*.

With the function switch in the sharp peak position, selectivity down to about 200 hz is available for CW reception. In some installations, it may be possible to obtain 100 hz selectivity.

How to Use It

The peak can be tuned across the *if* passband of your receiver to sort out a maze of signals very effectively. Using the Q-Multiplier in conjunction with a selective audio filter is just about the ultimate in effective CW reception. You really shave those signals close! I omitted the broad position in my installation, since the selectivity of my 75A-2 is set by a Collins 2.1 khz filter; but for those lacking a filter, the broad position is pretty effective for SSB reception.

In extremely crowded band conditions, it is possible to use the Q-Multiplier to separate SSB signals. With the selectivity advanced as far as necessary, carefully tune across the *if* passband. You'll find you can peak up the most essential voice frequencies of the signal you're trying to haul out of the mess. Under these conditions, the audio is very restricted, but you can copy! With a little practice, you'll find that you're able to slice away SSB QRM just as effectively as you can in the CW mode.

The rejection function should be familiar to most of you. It works just like a T-notch filter or the rejection function of the old style crystal filter. Tuning for the notch is very critical, and must be done slowly. It is also important to adjust the selectivity control for the deepest possible notch. This does not correspond to the setting for maximum selectivity. but falls around the middle of the control's range. The obvious use for the notch is the elimination of interfering heterodynes and adjacent CW signals. However, adjusted for a slightly broader notch, it will do a fine job of reducing QRM from adjacent SSB signals, as well. In the process, you'll probably notch a good chunk out of the signal you're trying to copy, but – again, with practice – you'll find it quite effective.

Building One

A few months ago, I picked up one of the old Heath Q-Multipliers from a local ham, tore it down, and rebuilt it in a corner of my 75A-2. The schematic shows the final circuit, except that it does show the broad position, which I omitted, for those interested. The original circuit used two pots – one for peak, and one for reject. Since the two functions cannot be performed simultaneously, I used only one pot on the panel, and put the pot for the reject position under the chassis, since it only needs to be set one time. I also changed the tuning capacitor from a 100 pfd unit to 50 pfd to obtain better bandspread within the passband. The 100 pfd variable tuned about 5 khz to either side of the center frequency. Those who will be using the broad position may want to retain the 100 pfd variable.

The Miller coils specified will work nicely in place of the Heath coils I used. The circuit layout is less critical than you might imagine, and point-to-point wiring is OK. Before making the connection to the plate of the first *if* amp, be sure your receiver is accurately aligned. With the Q-Multiplier off, adjust L1 for maximum signal. *Do not repeak the receiver* if, or you'll degrade the Q-Multiplier's performance.

With the tuning capacitor at mid-point and the Q-Multiplier in the sharp peak function, adjust L2 for maximum signal. Repeak L1 with the Q-Multiplier off and L2 with it peaking about 3 or 4 times, as there is some interaction. Now check for the performance of the rejection function. The tuning point of maximum rejection will be just slightly different than that for maximum peak because of the capacity of the second triode switched in the reject function.

That's it. You should be ready to roll. You'll find the Q-Multiplier to be a valuable addition to your receiver. I hope these ideas will stimulate some new interest in this most useful and versatile gadget. Since Wayne Green was responsible for introducing it, it's most fitting that he should have a hand in re-introducing it!

. . . W8RHR

Gerald Price VP2AC
Care of Antigua Star
P. O. Box 114
St. John's, Antigua
West Indies

Activation in VP2

Both in the American phone band and the DX section, hams continue to say the only VP2s that we have not worked are Anguilla and the British Virgin Islands. Meanwhile several hams would like to take along their rigs while holidaying in the Caribbean. Because of this I am writing an account of my recent DXpedition to the islands.

A request to VP2MY Frank, the managing director of Leeward Islands Air Transport (LIAT), for a complimentary flight to the islands was answered with an immediate roger, Frank is a patron of the Antigua Amateur Radio Club.

My next move was then to get a license and permission from the St. Kitts Government to operate on Anguilla island. Anguilla was a ward island of St. Kitts, but has since seceded in June, 1967.

A telephone call from my home QTH in Antigua to the telecommunication officer in St. Kitts resulted in my learning that the officer had QRT to Canada on business and that I should write to the Chief Minister of St. Kitts for license and permission.

A hurried letter to the Chief Minister was answered by the Minister of Communication requesting evidence of my British nationality before consideration of the license could be given.

Jerry VP2AC making first stop in St. Kitts to get government permission to operate on Anguilla Island. The rig here is an HW-32 with a Hustler vertical.

My scheduled time of departure was too short for correspondence, therefore it was necessary to call at his office in St. Kitts; and after routine inspections of my Antigua license, etc., I paid for my VP2K license and I was given the call VP2KC.

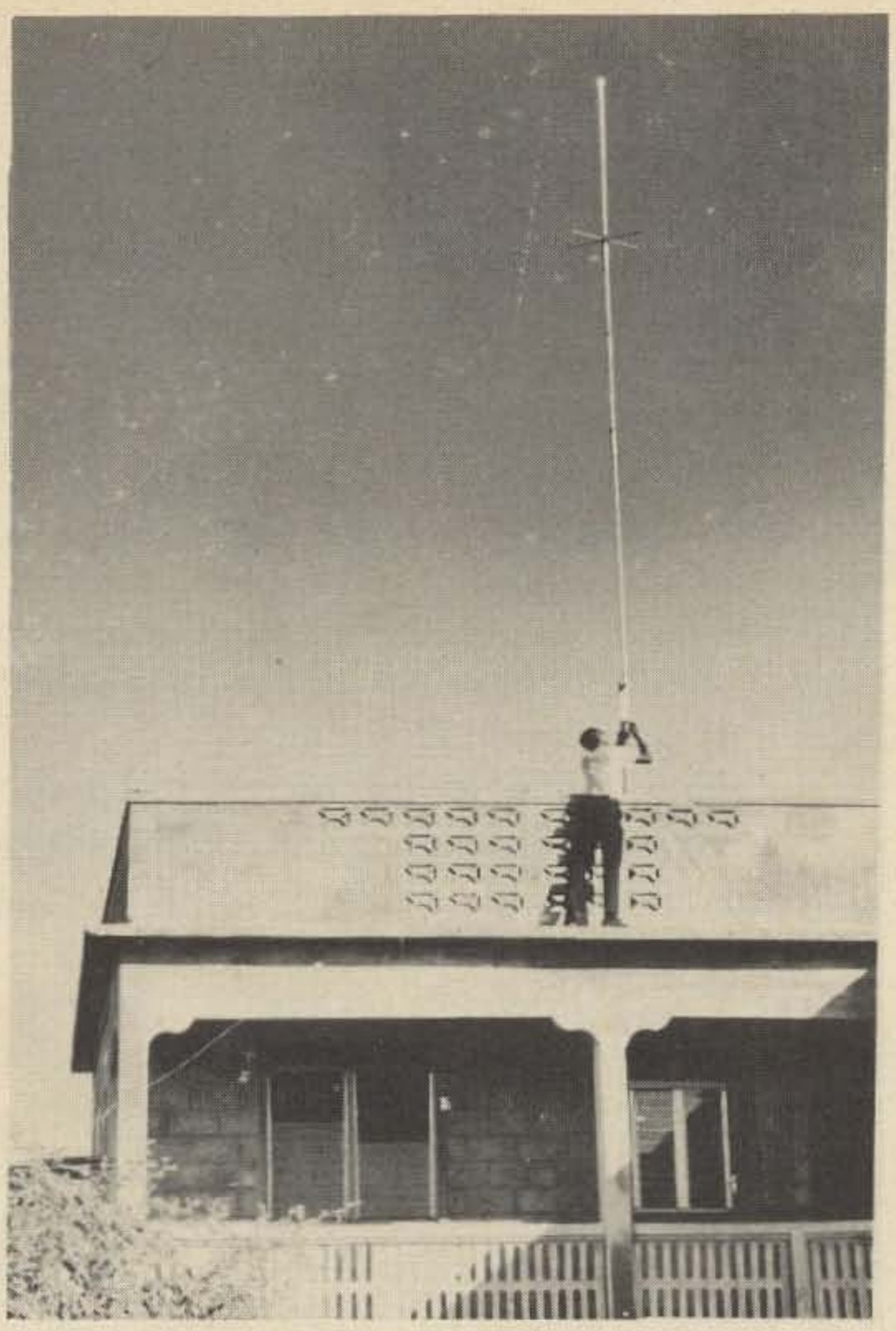
About 15 days before leaving on the DXpedition, Hurricane Inez destroyed my Hygain vertical which was slated for the trip with my Hot Water-32.

An immediate request to New-Tronics Corporation in Ohio for a Hustler vertical brought a donation of a 4-BTV Hustler which I received five days after the request via Amateur Radio Center in Miami, Florida.

On St. Kitts island it was necessary to transfer to a smaller aircraft which would fly to Anguilla, about 60 miles north. This created an immediate problem – the 6 foot by 1½ inches pipe and the vertical which was telescoped to 5 feet 8 inches could not fit into the small aircraft, and with only 15 minutes before QRT time, I hurriedly bought a hacksaw blade, quickly cut off 18 inches of the pipe, reduced the antenna to about 5 feet and scrambled into the six-seater.

On Anguilla island, I booked in at Lloyds Hotel, the most elevated location in The Valley – the capital or chief town. The hotel was the only place too that a generator could be rented at a moderate price – there being no electricity on the island.

Anguilla is a fascinating island in the northerly Leeward group of the Lesser Antilles in the tropical waters of the eastern Caribbean. It is a flat island stretching eel-like for approximately 15 miles. Prob-



Hustler antenna is being connected on top of the hotel room in Anguilla Island. From this location about 600 contacts were made, including WAC and 65 countries.

ably named L'Anguilla by the French who first owned the island, which in now populated by about 7,000 people.

The antenna was ready shortly after I arrived, and it was placed on the roof of the hotel. From here the sea was visible from all directions way out to the horizon. In the distance 12 miles away was the French-Dutch island of St. Martin silhouetted by the sun.

The generator was set into motion, voltage check – 118 volts ac. The HW-32 loaded okay. The American phone band was crowded and QRM plus plus. I gave several CQ's which resulted in no reply.

In the DX section the first station logged was VE3BWY Ham with 5 x 9 sigs both ways. Second day on Anguilla the first stateside station logged was W2RSJ and then the pile-up. All districts in U. S. A. were worked except the 7th district during the five-day stay on the island.

Several VK's were worked every day, including my good friend VK4HR, Harry, who was on the lookout for the DXpedition; and among the 600 contacts on Anguilla was the ever-popular PY2PS, Eva.

From this QTH WAC was logged and surprisingly the Russians were contacted long after 1300 Zulu unusual at this time in our neck of the woods.

We regret that several of the DL's were not worked when they were coming in 5 x 9 plus about 2000 Zulu, but the generator stopped and it took sometime before we got it going again. Then conditions to DL land had changed, and the DX section was practically dead.

But the American Phone Band was a bee-hive of activity. Several stations were logged before I found out that I was sandwiched between two other DXpeditions, VQ9AA Don on Aldabra and FH8JF Hosay on Comoro island who were working just about 30KC apart.

Tortola in the British Virgin Islands was the next QTH of the DXpedition, but before QRT from Anguilla I observed that the local government was preparing to install 220-240 volts AC in The Valley. The next DXpedition to Anguilla may be much more comfortable for the operator.

To get to Tortola from Anguilla it was necessary for one to enter St. Thomas in the American Virgin Islands if one wanted to travel by air. While booking for St. Thomas it was discovered that my certificate of vaccination against small pox was missing, possibly left in Antigua.

A quick check with the only doctor on the island and I was revaccinated and given a certificate. In St. Thomas swift motor vessels and sea planes travel to Tortola, and to cut down traveling expenses, I packed the equipment in one of the vessels, and I was happy I did because I made a good study of the islands. I was amazed with their number and proximity. Here, there and everywhere were islands – Virgin Gorda, Anegada, Jost Van Dyke, Salt Island, Peter Island, Cooper Island, Norman Island, Marina Cay, Guana Island and many other islands ranging down to mere rocks rising from the blue waters. We sailed through Sir Francis Drake's Channel and tied up to the pier in Road Town Harbour.

The Tortola customs insisted that I pay duty on my equipment, but after some

explanation, I was allowed to pass through free of duty, pending some further investigation into my true mission.

On Tortola island, the Administrator, the Telecommunication Officer and the Inspector of Police gave me every assistance to get up the station. Thanks to to the Chief of Police in Antigua, Mr. Edmund Blaize, who sent letters asking for assistance and recomendation to the DXpedition. Mr. Blaize is a patron of the Antigua Amateur Radio Club.

The capital Road Town is a true valley completely surrounded by high mountains with an opening from the sea. To my mind this location was not ideal for a DXpedition – and I had decided to QRT to Marina Cay three miles away, but this would necessitate renting another generator for electricity – and enough money was not available for this, therefore I set up station in Road Town, and after 5 days operating here 560 stations was logged.

Tortola is the largest island in the British Virgin Islands with a population of about 8,000 people who have a strong inclination to be Americans, and are greatly influenced by their neighbours, the American islands St. Thomas, St. Croix and St. John.

First station logged from Tortola was YV2GT sharply followed by W1CLX and the pile-up bounced in over the mountains with amazing 5 x 9. Another popular YL logged in the pile-up was W1RLQ Grace who was worked at all the stops as well as from the QTH in Antigua.

Several Africans were worked every day after 2000 Zulu. The SM's were constantly logged and several HB9s were buried in the QRM. My good friend VP7NA Harold from the Bahamas was logged and we chewed the rag for a few minutes. All the Canadian districts were worked, and at the end of the Tortola operation WAC was again logged and 65 countries worked.

My QSL Manager WA4AYX Pete was constantly monotoring the operations through the islands, and the courtesy of the American hams was indeed commendable – while my QSL Manager and I were in QSO, they were all QRX until he was through.

And another commendable factor of the Stateside hams was the orderliness in which the boys came in when called in districts. Being transcieve I had to call in the stations by districts because of the tremendous pile-up.

My next stop was the island of Barbuda, and I had first to return to Antigua. Flights to the ward island 40 miles north of Antigua were all booked until one week later. Having only 25 more days of vacation I decided to move immediately and boarded a fishing vessel for Barbuda.

I was the sole passenger and after six hours' sailing we anchored in the placid lagoon of Codrington Harbour.

No electricity was available on the island and therefore I set up station at the Police Department with the kind permission of the Chief of Police in Antigua.

The police generator delivered 230 volts ac and we stepped down the voltage to 116 volts to power the Hot Water – 32. The police officers, some were my schoolmates, helped me get up the antenna. We went on the air immediately and first worked K2CWQ who is believed to be the first ham to work Barbuda; there being no record of a station being set here before.

Station K7TNE Meg was worked and this was the first and only station logged in the Seventh District through the entire DXpedition. After 5 days of spotty operation, 480 stations were logged with a new bird FP8AC on St. Pierre Island. At this moment a YV5 broke on the frequency and wanted to take over operation, but I would have none of it.

Barbuda is a very flat island with highlands up to about 200 feet in the northern section of the 62 square mile land. It is almost all of coral formation with a very large lagoon on the western side which leads to the main and only village, Codrington, where 1,200 people live like one big family.

It is one of the few islands where wild deer are still found, and the only island in the Caribbean with beaches of pinkish-white sands stretching for more than 15 miles.

My QSL Manager Pete has been and is still handling the QSL cards for Anguilla, Tortola, and Barbuda DXpedition.

My next DXpedition is being planned for Dominica (VP2D), St. Lucia (VP2L) and St. Martin (FM7).

. . . VP2AC

Arnold J. Cain, WB4FDQ
375 Ruffner Road
Melbourne, Florida 32901

The CR Beam

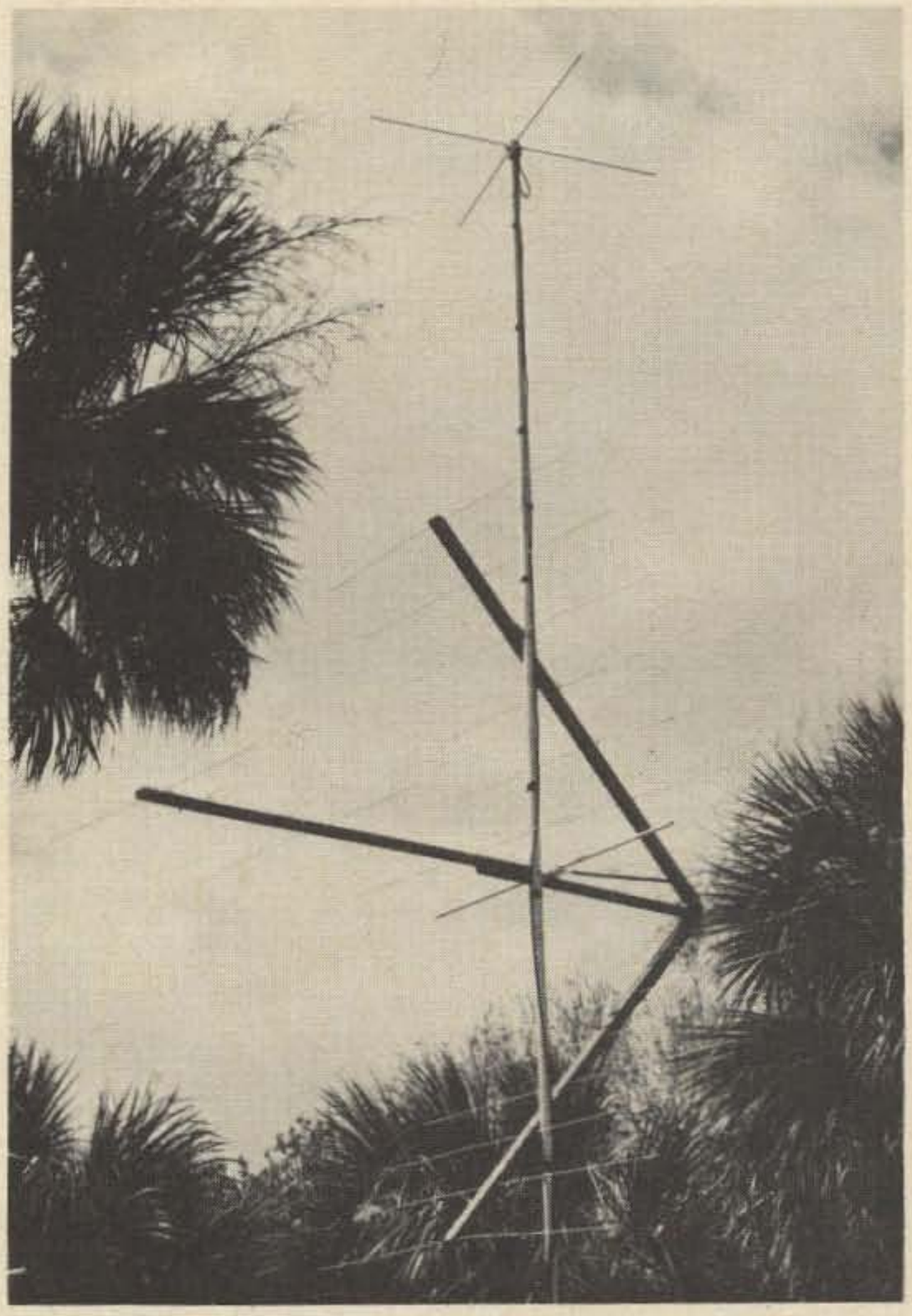
It seems now, that my two-meter antenna has been up there for ten years, but on checking the log, I find it has only been a little over two. Of course, it may only seem that way because, in this neck of the woods, a lot of hurricanes and high wind conditions have tested their strength on this rather frail looking piece of gear. I am happy to report that it's still doing what its supposed to, in spite of them all!

The closest we have come to disaster was last fall. During a three-week down-range trip (I was working at Cape Kennedy as a cameraman at that time) Melbourne was sideswiped by a small, freak, tornado. On my return I found that the two-inch, thick-walled aluminum conduit extension mast that supports my rotor and hf antennas (and which is guyed, top and bottom) at the top of my tower was bent at a forty-five degree angle from the vertical, leaving the antennas facing the ground but otherwise intact.

This small twister had demolished quite a bit of valuable property in our town, including a beautiful tri-band array at the QTH of W4JHM, only a hundred and fifty yards west of us. It took me exactly thirty-five minutes to saw off the five-foot bent portion and get everything back up in the air. So much for the ruggedness of this kite.

As you will see, this antenna, even if you don't scrounge (as I do) but buy all of the component parts, will cost almost nothing. As for efficiency, I'm sure there are antennas you can buy or build that will give you more gain, greater front-to-back ratio, etc. However, for simplicity, ruggedness, ease of construction and compactness, plus broad bandedness and, last but not least, cost, you will have to go far to beat this one.

One more word on efficiency. I, like most of our breed, do not have access to high-priced lab equipment, but I do have, as you do, friends and fellow hams. K4JKX



lives about fifteen miles away. Using a nineteen-inch ground plane at his QTH, he was copying me at less than one half S unit on his SR42, while I was transmitting on a turnstile at about fifty feet of altitude. After switching to my little CR beam, he reported S 5-6, a gain of 4½-5 S units. If this isn't good enough performance for you, you'll have to experiment with one of your own. So, to work!

The basic materials for this rig are a ten-foot length of 3/4 or 1-inch aluminum or steel mast, two six-foot and one eight-foot lengths of one-by-two-inch cedar, a 100-foot coil of aluminum clothes line, (you will have about 25 feet left over) 40 inches of ½-inch aluminum tubing, and assorted bolts, nuts and insulating material. The 3/4-inch or 1-inch aluminum tube will be the mast (I put my turnstile for local ragchewing, on top).

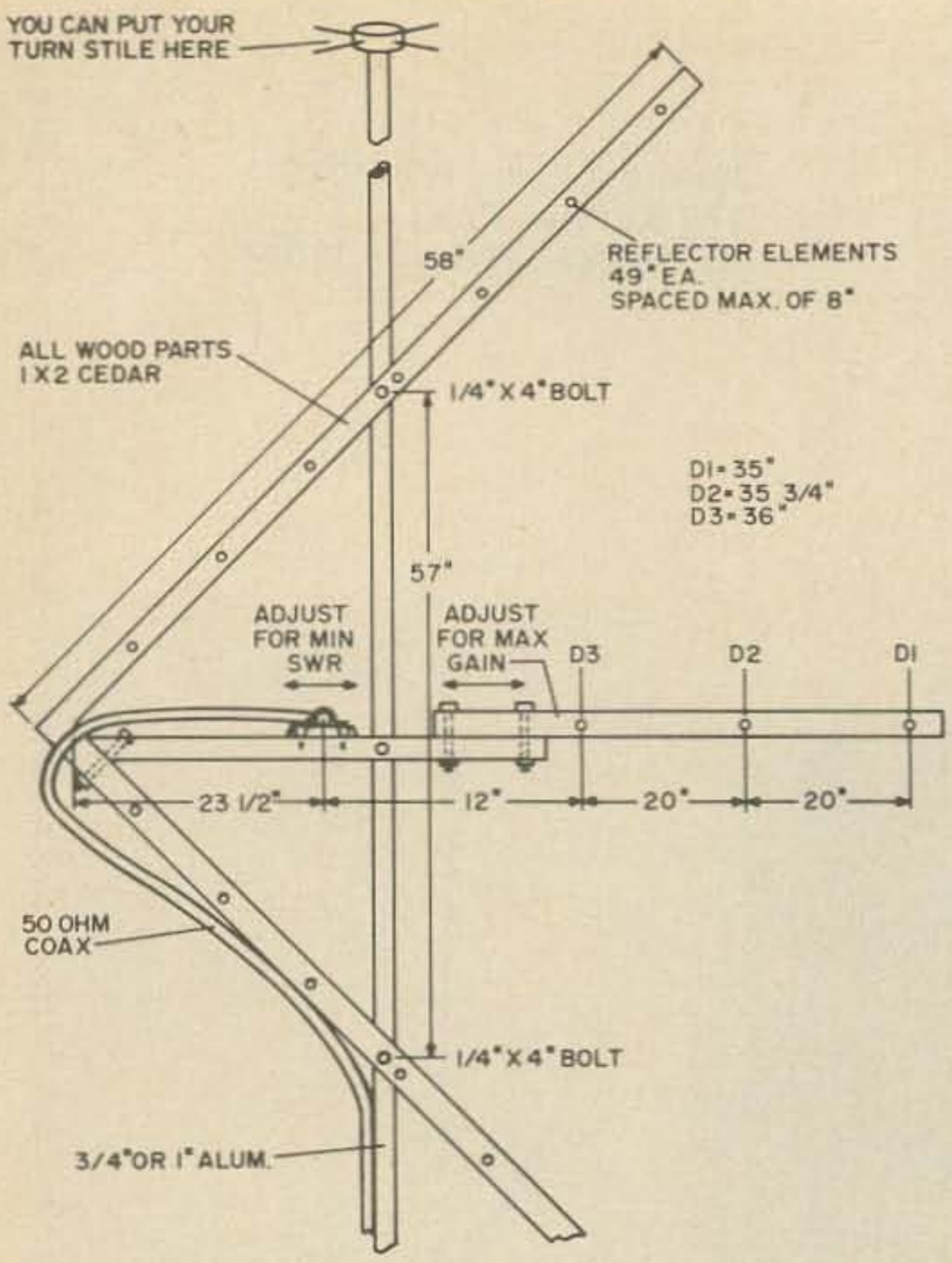


Fig. 1. Corner reflector construction.

Drill holes in the tubing for bolting the 58-inch lengths of cedar, approximately 28½ inches either side of center and drill the same size holes (to pass ¼ x 4" bolts) in the 58-inch cedar strips about 39½" from one end of each strip (the ends that will form the apex). Drill holes, for force fitting the aluminum clothes line reflector elements in the cedar strips every 8 inches, measuring from the apex or corner end (you may put an additional element at the apex if you wish – I never got around to it). Straighten the clothes line by anchoring one end to a tree or other firm object and tugging gently but firmly with a car on the other end. You will wind up with a nice, straight piece of aluminum wire from which to cut your 49-inch reflector elements. Force the elements into the holes in the cedar strips until they are halfway through. I put a drop of weldwood glue on each side of each element and have never touched them since.

An important thing to remember at this point: don't put the reflector elements in until you have layed this out on the ground with the reflector frame strips loosely bolted to the mast, because you will have to drill another hole in the mast for a bolt to support the boom. The boom will be made in two pieces so that the director elements will be in line (horizontally) with the driven element, and the driven element in line with the apex of the corner reflector. To have these parts line up accurately, the bolt hole will have to be a bit below the center and it is much easier to do this with the whole assembly laid out on the ground. Once you have your holes drilled and are sure of your alignment, you may proceed with the assembling which will go rather quickly.

For final assembly, I fastened the mast up vertically and bolted the reflector frame to it with the elements glued in place and ran a thin bolt through the back end of the boom and the reflector frame. I put the drive element on last. Make sure that you bolt the wood strips all on the same side of the mast. It looks awfully funny the other way.

Finally, the driven element – I must say at this point that I make no claims for originality concerning any portion of this rig – and the drive element is no exception. However, in self defence, I have found that combining these various components in this particular way may be a bit original. The driven element has been written up before, under different titles. Finding it to be all it was ever claimed to be, I am using this feed on all of my antennas. Construction is simple, quite weather proof and gives me an SWR of 1.5-1 across most of the band. The whole element consists of a half wave dipole of ½ inch aluminum tubing fed by a transformer consisting of a ¼ wave piece of RG8U coax-shorted (center conductor to outer braid) on each end and well taped, after which the outer insulation is cut at the center. The shield braid is cut at the center and separated by about 1 inch and soldered to about a four-foot length of RG8U. One side to the braid and the other to the center conductor of the feed line. All joints are taped with plastic tape to weather proof and then the ¼ wave piece is slipped into the ½

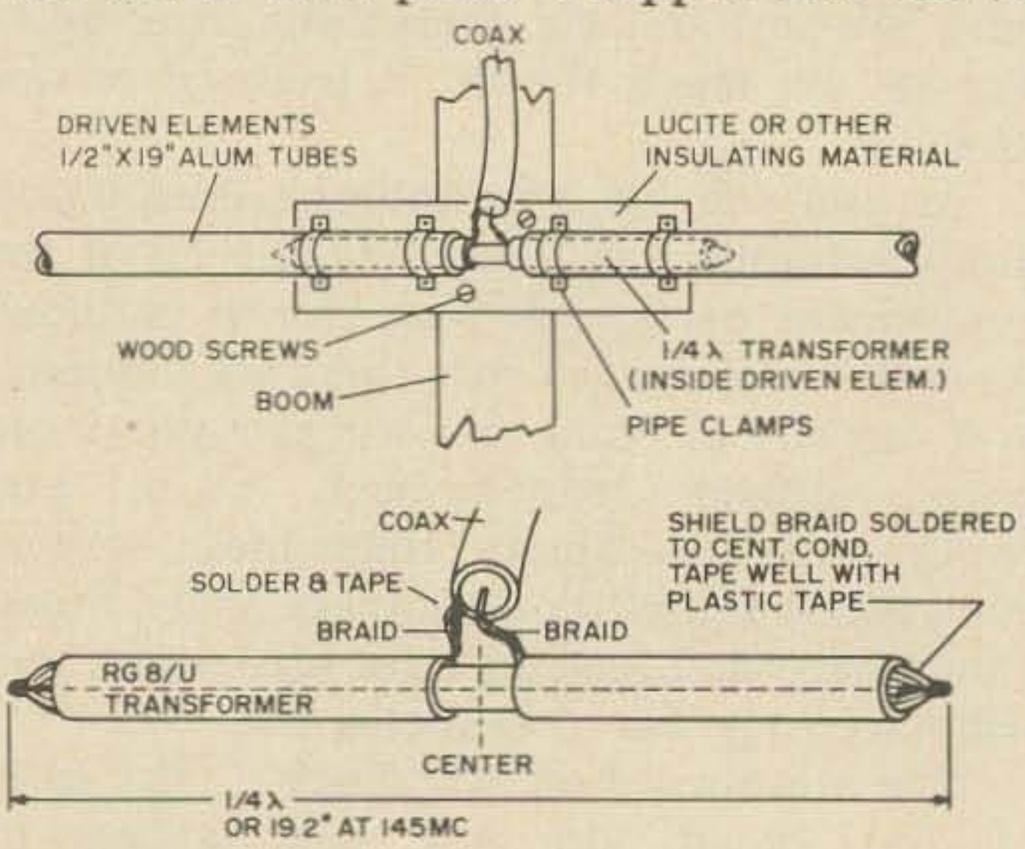


Fig. 2. Details of driven element.

wave dipole leaving the four-foot section of coax for feed line.

You can solder your coax feed directly without the four-foot piece, but I like the convenience of a short length for testing and pruning purposes. When I built mine, I made each driven element about 19 3/4 inches long and mounted them on a piece of scrap ¼ inch plexiglass. Any good H. F. insulating material will do, even bakelite, but I prefer the high polish of the plastic for our salt and weather conditions. After mounting the driven element, I prune it to 145mhz using my grid dipper, an impedance bridge, and a cheap (95c) tubing cutter. The final touch up was made by sliding the element back and forth for lowest SWR and doing the same for the directors for highest front gain. The sketches should make everything clear.

That about does it. I'm sure that if you follow the pics and diagrams reasonably closely, you will wind up with as good a signal squirter as mine. Good hunting on "2" and "73"s.

. . . WB4FDQ

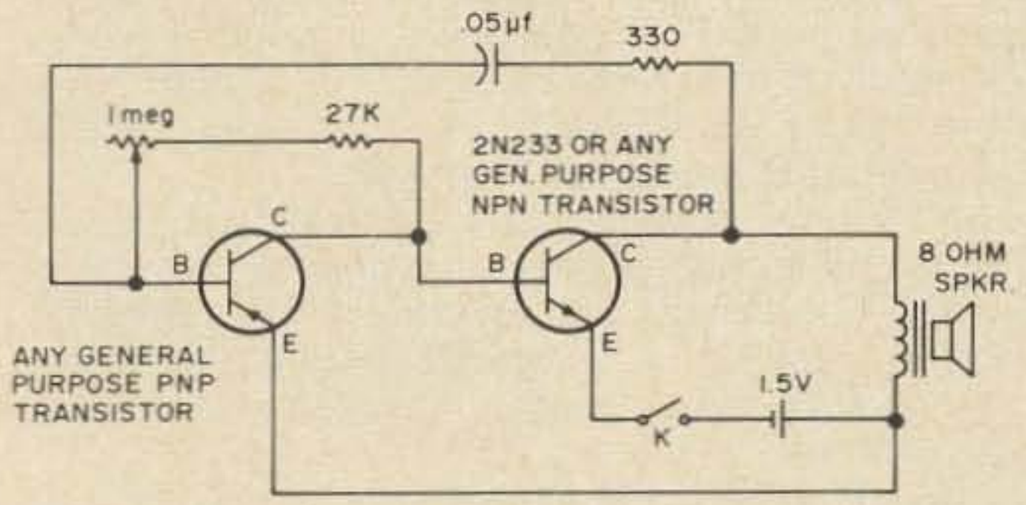
References

"Infinite Impedance Match," 73, March, 1963 p. 20.

1965 ARRL VHF Manual, pp. 208 and 225, Figs. 9-31.

A Simple Code Oscillator

This code keyer has a wide range of frequencies to please the tastes of anyone who wants to learn the code. It uses very few parts and can be housed in the base with the key. The circuit uses two inexpensive transistors, one a PNP, the other an NPN; almost any type can be used.



A simple code oscillator

The unit is assembled on a 5 x 2½ inch piece of phenolic board. All the parts except the 1 megohm pot and 27 k resistor are mounted on the underside of the board.

Ray Ezelle, WA8YWK

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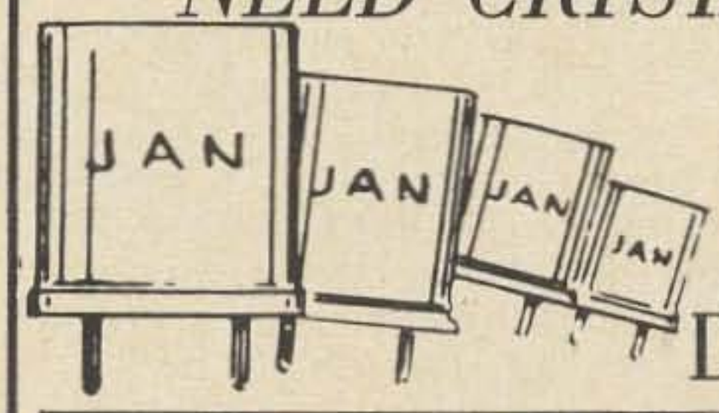

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The ARRL Board and Amateur Radio

A. David Middelton W7ZC
Box 303
Springdale, UT 84767

The Annual meeting of the ARRL Board was held in New Orleans on May 2, 1969, following several days of informal gatherings, committee meetings and socializing.

A serious attempt was made in the early '50s to hold every other Annual meeting in a place away from the shadows of the Ivory Tower in the Hartford area. Denver '54 and Montreal '65 are two locales of this meeting of the Board and the HQ entourage. There may have been other travels for this important (to amateur radio) affair where the fate of AR may be decided or at least influenced. However, most such meetings are held near HQ.

Present in New Orleans were fifteen directors and one vice director acting for his ailing director. Also present; a clutch of VPs; the General Manager-Secretary, the Treasurer and four vice directors (who did not get their expenses paid by ARRL) and a bevy of HQ personnel. Missing from the roster was ARRL's Public Relations Counsel (Item 101 of the 1966 minutes requests that a study be made of retaining PR counsel to attend all Board and Executive Committee meetings). Also missing –any representative of HQ's technical staff.

In reporting the activities of this meeting, material has been placed in associated areas, each listed in a tentative "order of importance" related to the present and future of both AR and ARRL. References are made by Item number and are not in the order found in the mineoed minutes prepared and distributed by the Secretary. Category headings were selected by this reporter.

Public Relations–A motion (Item 12) passed (11-4) that a study of, and recommendations be made for, a form of Field Organization which will provide contact between HQ and those members whose interests do not presently coincide with the interests of the Communications Dept.

What ever became of the request for a Field Organization setup–made by a previous Board a few years ago? Such a F. O. is long over due and badly needed to bring ARRL to the field!

After extended discussion, during which it was almost tabled, Item 39 requests (13-3) that a suitable publication be written by ARRL (after consultation with reading specialists) directed at the 12-16 year old group.

The idea is commendable. The negative votes are inexcusable.

A unanimous affirmative vote (Item 41) instructed the General Manager to take steps leading to the addition of an "introduction to Amateur Radio" course to high school and adult education classes.

This too is an excellent idea, but it will require heavy follow-up.

A unanimous vote (after discussion–Item 44) instructed the General Manager to periodically publish in QST information on ARRL's structure, including directors and SCMs, and to include a glossary of ham terminology.

This will be excellent PR and should enhance relations between ARRL and the AR body. All too few licenses know what ARRL is all about and many care less! Such indifference does not always involve personalities but is often related to ignorance of basic ARRL concepts, aims and goals. With new blood coming into AR, and with the ever expanding fields of endeavor in AR, ARRL should do a better selling job of itself.

According to Item 60, a unanimous vote requested the General Manager to have the PR Counsel prepare material for distribution to prospective members that will convey the tangible value of ARRL affiliation to the individual.

This idea, together with that immediately preceding it, may make ARRL membership more meaningful to amateurs. This PR work is in the right direction since HQ has failed to do its job on this. Follow-up is necessary, if it is to succeed.

Item 81 states that W4GSX will be presented with ARRL's 1969 Technical Merit Award for his analysis of typical amateur antennas using modern computer techniques.

W4GSX's work will be awaited impatiently by many who have been looking for a typical antenna! Maybe he has the answers!

This reporter (the originator of ARRL's Merit Award) is always delighted and proud to see this Award made as some times the Committee has passed it over being unable (?) to find anyone worthy of the Award. It should be noted that the original motion creating this Merit Award included HQ actions to properly circulate news of the Award to non-amateur media in order to obtain the greatest possible PR from the amateur's work, which resulted in his Award. Such PR has not been properly done and much of the value in the non-amateur PR world has been lost.

The General Manager was requested (Item 87) to "continue an advertising campaign in magazines which might be read by individuals who are likely to have an interest in becoming radio amateurs, in an attempt to attract more individuals into the amateur service."

Such advertisements should be of great value to AR and to ARRL. The word "continue" implies that such advertising has appeared. This reporter would be grateful for clippings of such ARRL-placed ads as so far they have escaped his notice with one exception.

Defense of Amateur Radio Frequencies–The Dec. 31, 1968 ARRL financial report indicates under "Reserves–for defense of amateur frequencies–$62,413.52."

This is the balance of a $100,000 fund furnished ARRL's President Hoover, W6ZH, some

years ago and which had become depleted with PR studies and other expenses.

Item 30 states "on motion of Mr. Chapman, unanimously voted (Messers Spencer and Thurston *abstaining* [italics supplied–ADM]) that, in view of an announcement of a forthcoming conference of the International Telecommunications Union, the Board replenishes the $100,000 fund for the defense of amateur frequencies."

Although little has been heard from the original $100K or the nearly $37K spent to date, this fund could become a vital weapon in the battle to preserve and protect our frequencies in a world that seems determined to take over all low and medium high amateur bands in their obnoxious spreading of their own brand of propaganda.

All amateurs should be keenly interested in what ARRL does and what it accomplishes with this $100K fund. This reporter has seen little of the results except the Stanford and Waters reports. The latter, at least, was worth it! That, plus some HQ staff junkets to foreign lands is what has been seen in QST.

ARRL can afford to spend almost its entire resources in order to effect suitable safeguards that will help preserve and retain our useage of all bands. $100K, if properly expended, can do a great deal of good for AR!

ARRL Membership–Item 42 orders that a postpaid insert inviting membership be included in selected ARRL publications and in QST, once a year.

The necessity for such a Board directive escapes this reporter. HQ should have been doing this for years. Such a motion, or the need for it, raises the question–does ARRL HQ really want ARRL to have more members? More members–more work–remember? How about an ARRL membership contest–with prizes? This idea (Item 42) should bring results–if it is followed up.

QST–A motion to include a propagation column in QST was lost when it was tabled (Item 66) by a vote of 12-4.

Some will argue that this information appears in other publications. True, and some have wide circulation, but what about those die-hards who read only QST–and need this information? ARRL should serve its membership regardless of other publications.

Item 68 requests a study to secure more rapid delivery of QST in 6-land, KH6, KL7 and all parts of US and Canada and requests that the results of this study (by the General Manager) be made not later than the next Board meeting.

In by-gone days one could tell the date by the arrival of QST. This reporter believes that the poor delivery is not the fault of the QST and HQ staff, and offers a thought that perhaps the postal employees are delaying QST by reading them before delivery! Could be potential amateurs? Maybe! If they were ARRL members they would get their own copy and thus perhaps speed up ours!

ARRL-FCC Matters–This category is lengthy and somewhat confusing. An attempt will be made to simplify the various proposals and their fate at the hands of the Board.

Item 13 requests that ARRL petition FCC to permit Conditionals or higher in the KL7, KH6, KP4 and USA insular possessions to use phone on 21.2 to 21.25 mhz. Also, that ARRL consult with IARU regarding a future petition to FCC to permit phone on these same frequencies by Extras. An amendment withdrew the IARU bit, but the amended motion was defeated. No vote count was given.

Item 14 would petition FCC to permit Techs to use 29.0-29.7 mhz. This was amended to read 29.5-29.7. Vote–14-1 with the Canadian director abstaining as is done in matters pertaining to FCC.

The Planning Committee was instructed (Item 19) to consider the feasibility of petitioning FCC to–

Expand 75-fone to 3750-4000.
Move 80-Novice to 3650-3700.
Expand 40-fone to 7150-7300.
Move 40-Novice to 7100-7150.
Expand 20-fone to 14175-14350.
Move 15-Novice to 21100-21200.

This Item 19 also instructed that a report be made by the next Annual Board Meeting. This motion was amended to establish liaison with IARU to evaluate international aspects of these possible changes and to report by the next Annual Board Meeting. The amended motion was passed. A large follow-up tag, please, Miss Blue!

IF Item 37 is followed through and IF FCC acts favorably, devotees of the art of EME, MS and other valued VHF/UHF pursuits will be granted higher power.

Note the IFs in that statement. High power would tremendously aid important work being done by pioneers in the most valuable facet of amateur radio yet encountered and which may well become our only area of activity in the near future.

Item 53 requests FCC to make 144-148 available for Technicians instead of 145-147. ARRL will so petition FCC.

After all somebody has to use those highly valuable 4 megs! It is assumed the Techs would have the same fone-cw regs as others.

If FCC agrees with the motion made in Item 55, potential Extras will only have to wait one year to take the Extra exam instead of the current two years.

Note the IF. This is a good idea, and let's hope FCC likes it. Novices and Technicians will benefit if the intent of Item 55 is OK'ed by FCC and permission is granted for Techs to obtain a Novice license without surrendering their present license and waiting one year.

An excellent proposal will be made to FCC that a typewriter (provided by the amateur) be permitted in copying code exams. Item 73 (always a good number) covers this but its originator, the well-known contester and triple-A CW op, W4KFC, overlooked petitioning FCC to permit headphones over the ears of aspiring examinees! Any trembling gun-shy neophyte will welcome a mill and maybe, someday, headphones again,

Item 74 (which was passed) requests FCC to assign 1x3 (preferred) calls to Extras who request and pay the fee, such calls to be assigned on a random basis.

If this idea gets FCC's nod, some Extras may get desirable calls. Oh, for the old days of call-swapping and initials in your call and all that sort of thing, sans computers!

MM boys will be pleased if ARRL's support (Item 95) leads to FCC's approval of MM on 7 to 7.1 mhz.

AR will benefit if MM is so allowed, as MM-working is both exciting and valuable for contactees.

RTTY addicts will probably rejoice if FCC grants RTTY operation on 28-28.5 mhz (Item 96)

but this is not likely to be favored by non-RTTY ten-meter ops!

This same Item 96 asks FCC to move "CW only" operation from 147.9-148 to 144-144.1. It should have been there long ago. ARRL endorsed FCC's docket 18508 covering this item.

Although belatedly, immigrants to our shores will be permitted ham licenses (after filing their first papers) if K7UGA's bill S-1466 and SJ Res 27 become law. ARRL approves this (Item 97) bill as should all other American amateurs. Reciprocity works wonders!

ARRL HQ Station W1AW–HQ was ordered by Item 15 to establish beacon stations on one or more VHF bands, as soon as practical, to operate at regular hours and on a published schedule.

This recognition by the Board of the importance of VHF in the ARRL program, although belated, will be appreciated by all amateurs who realize the necessity for heavy HQ participation in VHF research if ARRL is to keep up with the state of the art and advance VHF/UHF. This reporter firmly requests that ARRL put an EME station on the air, without delay! ARRL HQ should lead the way–not follow the crowd!

Item 21 would have moved ARRL's W1AW code practice and bulletin transmissions out of the Extra Class portions of the bands, but the motion was defeated.

W1AW should be operated on the border (in the opinion of this reporter and others) between the high and lower class segments, where practical. ARRL's argument that W1AW is not a frequency standard station may be true, but perhaps the Comm. Dept. should investigate 1969-type high-stability transmission possibilities. Few stations are equipped with 25-khz markers (even if they have a calibrator) and W1AW could help them know where these borders lie. ARRL could not be held responsible for a legal WWV-type frequency accuracy, but being near the border (a no-mans land for the holders of the lower classes of license) could be a boon for all.

Item 49 (debated and finally adopted–vote 14-2) calls for W1AW to make a six months trial run of a repeat of the 0230 GMT scheduled code practice at 1300 or so, five days a week.

Why would any director (two did) vote against such an idea? Maybe these two did not wish to rise at 1300 to improve their code.

The ARRL Board has consistently persisted in using an irritating practice of "referral to a committee for study," or other delaying tactics when faced with a sticky problem with which they did not wish to cope or make a firm decision.

Item 67 is just such a delaying tactic as it authorizes a committee to work with the OSCAR group and Foothills College in California to investigate the establishment of a joint ARRL/OSCAR station at OSCAR HQ.

Is this to be the "west coast official ARRL station" mentioned in League Lines, June, 1969 QST or is this to be the $1500 ARRL Space Station?

The Electronics group (plus able volunteers from industry) demonstrated their many capabilities and abilities in the well-executed OSCAR programs to which ARRL gave lip service, some QST space, and the ARRL Technical Merit Award.

This reporter believes that a joint OSCAR/ARRL station would be like the infamous "horse-rabbit" meatloaf, made of equal parts, one horse and one rabbit. Name the horse OSCAR.

The idea of a west coast location for either a W1AW-type operation or a Space station is meritorious and should implemented without further delay! Yes, Virginia, there IS a west coast!

If this is the HQ's answer to the 1967 (Item 24) directive allotting $1500 for an ARRL Space Station, then why wait any longer?

The director of the Pacific Division (in which OSCAR HQ is located) is to be commended for his fortitude and success in getting a "study" ordered. But, why a study on a west coast ARRL station? There has been a dire need for such a facility for many years and it will be welcomed by all who live west of the Hudson!

The Board recognized AMSAT (see June QST) and OSCAR by (Item 99) appointing liaison directors to these timely and vital programs.

However, by their omission of NASTAR they indicated either their indifference to the placing of a ham repeater on the Moon, or their ignorance of NASTAR, or both.

$1500 for an ARRL Space Station? Many VHFers have antennas that cost that much. ARRL's stated worth (Dec. 31, 1968) was $1,244,288.45! Is ARRL really interested in VHF or not?

ARRL and VHF Repeaters–the modus operandi of the Board can not be more clearly demonstrated than in the progression of a good idea to a weak one–as shown in Items 20, 38, 51 and 89.

Item 20 (tabled) comprehensive reporting of and an interest in VHF repeater operation by HQ personnel and in QST space. Item 20 also called for a section of the ARRL H-Book to cover VHF repeaters and their operations. This motion was well organized, vitally needed by those who get their kicks form this newest facet of ham radio, a phase that is rapidly growing in popularity and usefulness.

Item 38 (tabled by a vote of ARRL's President, after a tie vote by the directors) called for a separate VHF REPEATER handbook to be written and published by ARRL.

In Item 51 the director who made the proposal in Item 20 (apparently in a desperate effort to salvage something from his good idea) amended his original motion, albeit emasculated, to request QST to carry news of VHF repeater activities in a principle subsection of The World above 50 MC. This amended motion was then passed.

The same director then proposed (Item 89) that ARRL include a section on VHF repeaters in the 1970 H-Bk. This motion passed.

Note that Item 89 calls only for a section in the '70 H-Bk.

Your attention is called to Items 20-38-51 and 89 as a study in Board procedure, when faced with HQ opposition and Board indifference! This study should be entitled–"how to have a good idea ruined without really trying!" The reporter is sure that ardent VHF repeater fans will have less than a huzzah for the Board on this matter.

Item 61 authorizes the General Counsel to file comment and to petition FCC to impliment the report of the VHF Advisory committee with consideration given the status of various related rule-making procedures now pending with FCC.

ARRL-RTTY Matters–ARRL approved (Item 17) FCC's Rm 132 (pending) permitting RTTY operation at 60, 75 and 100 wpm. Good thinking!

Director Affairs–Several motions were made regarding directors, their duties and other matters.

Item 11 called for procedure of impeachment of any office holder elected pursuant to the Articles of Assoc., the By-laws and the responsibilities of his office. This motion passed. Perhaps we may now have a method of ridding ARRL offices of incompetents.

At last (Item 58) ARRL directors (not vice directors) are authorized to attend ARRL National conventions with expenses incurred chargeable to authorized division allotments.

It might be noted that the 1969 ARRL National Convention was scheduled for Iowa, the home state of ARRL's president. Any connection purely coincidental.

Why has it taken until '69 to get such a worthwhile measure passed? Not many directors have the wherewithal to travel on their own expense and few can arrange "business trips" to permit their attendance at ARRL's own national event. This motion is worthy and this reporter trusts that all directors will take full advantage of it.

Item 36 (which passed) is of extreme importance! It is also highly significant of what may be a new progressive spirit in the Board.

A Special ARRL Board meeting is called for Nov. 1, 1969 to consider or act upon the following–

1. Actions pending before FCC.
2. Reports and studies of HQ staff.
3. Amateur band occupancy.
4. Committee recommendations.
5. Establishment of an ARRL Foundation.
6. Recommendations of Counsel regarding amendments to provide for two meetings of the Board each year.

This item also states that any other matters to be placed on the agenda may be added up to and including Oct. 22, upon concurrence of at least nine directors.

Note that a majority must concur even to get an item on the agenda. However, the agenda is potentially loaded!

Item 36 also urged directors to arrive at the site of the meeting as far in advance as possible and reasonable for committee and informal conferences.

This is SOP, allowing several days for informal (non-reported in QST) conferences at which most items are fairly well firmed-up and prepared for the "formal" reportable meeting. This May meeting was not marred by "committee of the whole" tactics. Several recesses were called for the purpose of discussion, off the record, and other necessary rest periods.

A second meeting each year, if made official and acted upon yearly (after '69), will be one of the most lasting and beneficial acts of the May meeting. The ARRL has long suffered from a communications gap with a year between meetings. This has often resulted in permitting the Exec. Comm. (which meets frequently) to act without referral to the full Board or to handle matters which should be Board-controlled.

A single yearly meeting for a megabuck corporation, is less than justifiable. This demand for a second meeting is commended. It is truly a step forward in directorship. If directors meeting in November will study the minutes of the May meeting as well as those of recent years and follow-thru on some of the unfinished business (tabled or otherwise) something of value may be achieved.

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147	20.00	DX100	39.00	VHF 152A	34.00
ELDICO		HW29A	34.00	RME 45	49.00
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ELMAC		HA20	79.00	**REGENCY**	
PMR8	69.00	HX30	125.00	HR10 Mon	59.00
PMR7	39.00	DX60B	69.00	**SWAN Electronics**	
AF-67	34.00	HR10	59.00	117AC	59.00
AF-68	69.00	HW12	79.50	406	45.00
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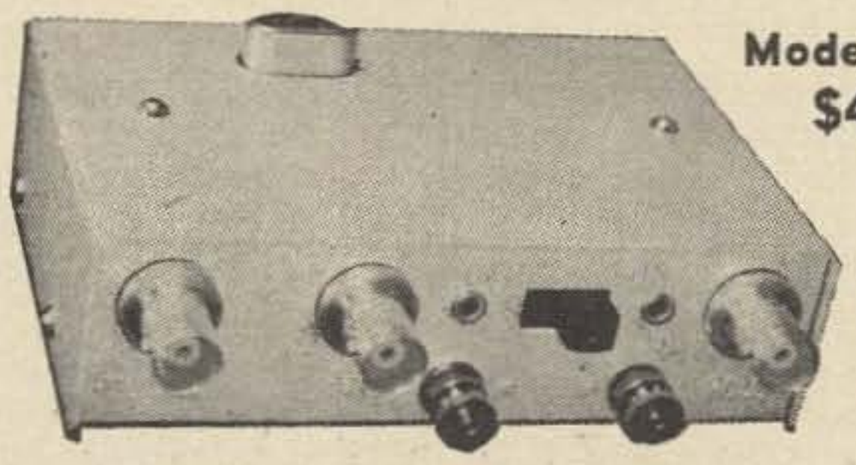

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The agenda of the November meeting contains controversial items and the meeting should be most intriguing!

Item 76 lists budgets for administrative expenses of directors for '69. These amounts are set by the individual director who may request any amount deemed necessary to spend in the interests of ARRL in his division. These amounts range from $1000 to $3200.

With the high cost of travel and printing, it appears that these figures are (for the most part) puny. There would be no objection if any director raised his expense figures although when this reporter was a director there was some effort on the part of many directors to see just how cheap he could be in his directorship, rather than see what was needed to really do a job of representation and request sufficient money to do the job.

Many directors must spend money out of their own pockets to fulfill their responsibilities and this does not seem proper when the ARRL gross income is large (1968–$1,498,574.62) and the need for better and more extensive communication between director and member is so prevalent. With larger budget authority each director could more effectively represent ARRL in the field.

Item 34 provides vice directors with advance copies of QST each month. Now, that is a magnanimous gesture on the part of the directors. At least vice directors get that much out of their almost non-existent duties. ARRL officers receive no salary.

One of the motions that can usually be counted upon at each Board meeting is contained in Item 92. This motion called for authorization to permit vice directors to attend (at League expense) one Board meeting during a two-year term of office. This long-needed authorization was defeated by a vote of 9 no–7 yes!

The thinking of those nine directors must be fuzzy. Why would not they welcome the presence of vice directors at the Board meeting so they could see what goes on, first hand, at these meetings. Many cannot afford to do this. Vice directors can only monitor the meetings anyway, and have little or no voice.

Vice directors, could if allowed and encouraged to do so, become a vital part of the activities of ARRL policy-making. But NO! Not only are they excluded from such opportunities they are forced to either pay their own way or obtain funds elsewhere to attend a convention or meeting. It is time that vice directors were recognized and brought into the ARRL political picture and activity to the fullest extent. Their talents are badly needed in the field!

Ironical as it may appear the ill-fated motion in Item 92 was followed by a unanimous vote of appreciation by the Board for the several vice directors present–ad nauseum! Such a motion seems rather puerile and in the case of nine directors, penurious!

Electioneering–Items 10 and 70 provide another example of Board stalling by referral to a committee of a sticky problem.

Item 10 calls for procedure wherein candidates (for director or vice director) would furnish HQ written information concerning his qualifications (not more than 200 words) and a list of his amateur radio affiliations. This material was not to contain any derogatory (by innuendo or directly) statements regarding any opponent for the office. This material to be prepared with a photo (if supplied) in a standard size sheet for each candidate so furnishing the information, and published, with no HQ editing, then enclosed with the ballot sent each potential voter. The same item provided that no lists of names and addresses or addressed envelopes be supplied to any candidate or his committee or to anyone for electioneering purposes. This motion was tabled by a unanimous vote.

Another stall was made when in Item 70, the same director presented an almost similar motion, albeit shortened, with the same motive. Another amendment assigned the matter to the Planning Committee for study. This amendment passed 10-5. The whole idea was then demoted to a "study of election procedures by the Committee" by another unanimous vote.

A uniform electioneering literature release, with the ballot, would be beneficial and would save much expense on the part of electioneering groups, provided, of course that HQ did not censor or edit such material submitted and that no difficulties arose as to what constituted "derogatory remarks," etc. All candidates would therefore have the same opportunity for exposure, at less expense, than with the present method which is unfair in that it gives a break to any candidate able to raise sufficient funds to widely advertise and also deprives candidates not so fortunate, who may be just as qualified for the office. Holding any ARRL office should not be contingent upon how much money a candidate or his supporters can raise.

This reporter hopefully looks for this reform at the earliest opportunity. And, that the intent of the original motion be preserved, in toto!

Item 46 is a somewhat confused attempt to secure redress through a committee of tellers for unfair, unethical or otherwise undesireable action by, or on behalf of an opposing candidate. Such complaint to be made in writing. A move to table was lost as there was no second. After more discussion, another tabling motion passed, 12-4.

The thinking behind this motion may be well founded but the intricities of handling such a complaint would challenge the mind of a Solomon. Regardless of that fact, tabling such a motion solves nothing and is an indecisive way of handling a hot potato but indicative of the lack of direct action displayed by the Board on such occasions. Sort of reminds one of the Congress! Sweep it under the rug, boys, and forget it!

Communications Department–In Item 59, the Board created a five-band WAS award to be initiated by the Comm. Dept. and effective after its availability.

This is an excellent award idea and should create a lot of interest in domestic operation but it is hardly a matter for deliberation by the directors of a megabuck corporation.

Why did not the Comm. Dept. just up and create this miracle and put it into use? Perhaps it was not their idea at all, and it does mean more work for the Comm. Dept.!

Those seeking credit for their personal net accomplishments will be pleased to learn that ARRL's Comm. Dept. will now recognize (a) net check-ins; (b) net control duties; (c) net liaison duties; (d) Emergency Corps participation; (e) phone patch operation. Points are to be established and reported in QST by SCMs. This motion was unanimously accepted in Item 65.

This reporter is fully aware of the importance of certain types of net operation and the training

value contained in some nets and does not belittle such activity. It does appear that QST space could be better occupied with articles on net operation and net concepts of general information to all, thus stimulating more interest in and understanding of the motives and practices of the better class of nets.

The point standings could be better handled in the Comm. Dept. voluminous bulletins sent to those interested rather than take away QST space from technical and other valuable material. Only a few QST readers have interest in traffic matters.

What a comedown for the Comm. Dept. to have to recognize phone patching and to have to issue points for it. Wow!

Stand by for a cut in readable QST space and an appropriation for computer rental!

The Board, after deliberation, established the ICAO phonetic alphabet (Item 63) as approved Now to get the lads to use it—or any other standard phonetics. It is unlikely that ARRL approval is going to reduce or change the silly practice followed by so many with their inane and confusing self-established phonetics.

Item 82 will change the rules-to require that candidates for SCM must have been a Full Member of ARRL and, to have held a General, Conditional or higher license, for two years.

This is a good move designed to insure better qualified persons in this important, unpaid and difficult task of being an SCM.

Item 83 places the determination of the standards of qualifications for an OO to be the responsibility of the Comm. Dept. Manager. OO—Official Observer—a volunteer Grand Island-type, with no authority or back-up to cause operators to "fly right." SCM—Section Communications Manager—a volunteer unpaid local representative of ARRL at state or geographical level. Reports in QST and handles traffic matters for his area.

Contestees will delight in Item 33 and all others (a majority) will climb the nearest wall! This item proposes a Comm. Dept. party once a year in which members are invited to work the League's official family of officers or appointees.

There used to be a similar type contest called LO Nite (League Officers Night) and it is surmised that this new bit of QRM-making "togetherness" may be in addition to LO Nite.

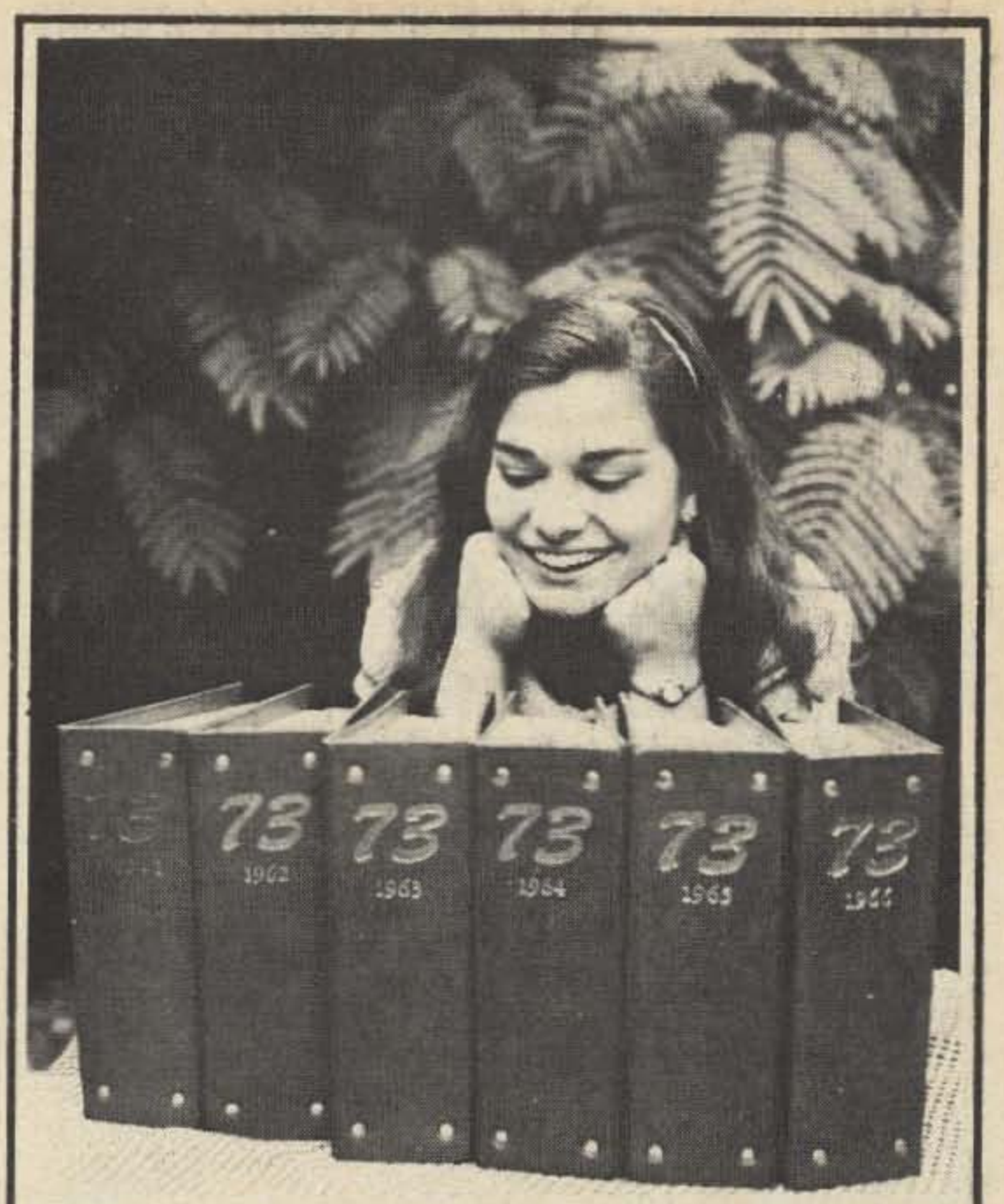
This reporter wonders if certain League officials will answer pointed questions during these QSOs? Let's find out!

SCMS and the Board—Item 18 instructs the General Manager to furnish each SCM (at his request and at ARRL expense) a set of training and operating manuals. The SCMs are perhaps the hardest working members of the LO, and they must be a real hardy breed!

ARRL and its Affiliated Clubs—Item 16 (which failed to pass due to no second) would have furnished a free sub to QST to any affiliated club who could produce ten members of ARRL who would sign such a request. The loss of this motion, due to failure of a second, is lamentable and sure is poor PR!

ARRL and the DXCC—The Board again delved into petty non-Board deliberations when (in Item 47-passed) it permits DXCC members to submit QSLs in increments of 10 after 250 countries havé been credited. A worthy idea—but hardly a matter for Board consideration.

Item 56 attempted to secure a unified countries



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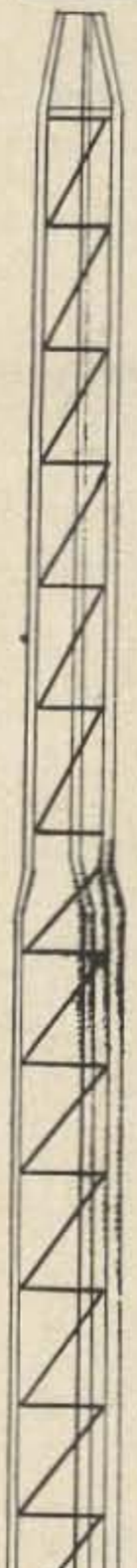

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list. After several amendments and much deliberation the following was adopted—"that the President and General Manager study the feasibility of implimenting preparation of a countries list jointly prepared by IARU societies."

This will solve nothing! Many of the important countries lists (and awards) are made by groups, organizations or publications who are not IARU members. The original motion was well-organized and important. Read it in QST and see for yourself. It should have been passed without debate. Now sometime we may have an IARU list, which will be dominated by ARRL's DX clique, and it will be ineffectual!

In the '50s this reporter advocated and fought for a DX committee with representatives of leading ham organizations, DX clubs and publications. This idea was defeated. Result—utter confusion in the DX ranks as to what, where, when is a country. By the beard of TOM—this IS a Rotten Mess!

ARRL Foundation—Item 28 instructs the General Manager and Counsel to promulgate the establishment of the ARRL Foundation, as a separate non-profit corporation. Objectives and purposes to provide ways and means for permanently establishing authority to utilize special funds and property of the Foundation and income therefrom under restrictions as might be imposed. (The motion is long and wordy and does not coinside with the version given in League Lines June QST). The Foundation would be managed by a Board consisting of the ARRL President, Treasurer and Secretary plus other director-elected members.

The basic idea appears to be a means whereby ARRL can receive funds (gifts, bequests, etc.) and expend them as a separate corporation from ARRL Inc. The outcome of this excellent idea will be forthcoming in November.

It is hoped that the Foundation will not be as miserly as is the official body of the parent corporation when it comes to advancing the state of the art of amateur radio and stimulation thereof!

ARRL and Assistance to Foreign Amateurs—Item 82 voted unanimously that ARRL continue its program of assistance, etc.

There is no quarrel with this motion except that ubiquitous word continue. Study of past ARRL affairs reveals little that has been done in this line and to continue along the present path of "assistance" does not seem to be of much value to anyone. ARRL could and should do a great deal in this line—but like many, this reporter believes that charity begins at home. Perhaps a communications gap exists between HQ and the reader-membership or perhaps it is another example of the familar phrase—credibility gap!

Conspicuous by its absence was reference to the ARRL Space Station ordered installed under Item 24, 1967 minutes, unless Item 67 can be so construed as to that station to be located at OSCAR HQ. No mention could be found in the '68 minutes of the Space Station.

Another matter not mentioned in '69 minutes was the ARRL out-going DX QSL bureau as discussed in Item 37 of the '67 minutes. A study and report was ordered (Item 17—'68) and was given to the Executive Committee Jan. 1, 1969, meeting 325. The committee unanimously voted against the establishment of such a bureau concluding "that it would be in the best interests of amateur radio not to expand the existing system."

The existing system is that of HQ receiving incoming QSLs and sending them to unpaid volunteer bureaus who mail cards to those having envelopes on file in the bureau.

This incoming system is excellent due to the hard-working and tireless group of volunteers but ARRL (the largest and most wealthy) amateur radio organization in the free world should long ago have established an outgoing DX QSL system.

The Executive Committee decision appears to be another example of abrogation of responsibilities by the Board who passed the buck to the Exec. Comm. whose record in the past has been toward the reactionary side.

There are at least two out-going QSL bureaus doing business at this time. Perhaps DXers are better off dealing with "private enterprise" than with an agency, especially if it does not want to do the job.

In addition to the above items the Board considered and acted upon various other matters in one way or another. Most did not seem of sufficient import to be reported here.

A sincere effort was made to preserve the intent and meaning of each motion discussed. Although some were paraphrased for brevity, in no case was any idea or motive deliberately distorted or taken out of context.

Deliberations and decisions of the ARRL Board of Directors (as well as those of the Executive Committee) affect ALL amateurs and AR. You are urged to carefully study the minutes in July QST and, with this commentary at hand, attempt to reach your own conclusions as to the results of this meeting.

A ball-park estimate of the items in the entire proceedings resulted in a tally of 38 that were beneficial, in one way or another, to AR, and there were 16 that were considered negative. You can make your own tally after digesting the minutes.

. . . W7ZC

A Cheap and Easy Power Supply

Earl Spence K4FQU
1413 Davis Drive
Fort Myers, FL 33901

Many of the transceivers on the market oday are packaged separately from the ower supplies. The easiest way out is, of ourse, to pay the $100 (or so) and buy the ower supply along with the transceiver.

But if you happen either to be obstinate r hold that $100 in a little more awe than eems to be average these days, you might vant to follow my lead and build your own ower supply.

First, let us examine what is needed in a ower supply capable of powering an SSB ransceiver of the NCX Class. Most similar igs utilize about the same voltages and urrents. We find that my rig required a final late voltage of about 700 vdc at 300 ma vhich is maximum current under load. A ias of 80 vdc negative at 6 ma, 280 vdc upply at 200 ma, and of course filaments, nake up the balance of the needed voltages. This is not a lot of power and can easily be urnished with a good husky TV trans- ormer. The transformer is the most expen- ive portion of a power supply and, natu- ally, the most important, so care should be aken in choosing it. Test the one you select o make certain it will deliver under pro- onged load without overheating. It is far asier to check before than after the supply s finished. Keep in mind that the trans- ormer has to produce full voltages under EP conditions so the full drain even at top oad is not extremely heavy. Therefore don't verlook a transformer just because it is not s big as a bread box.

My junk box produced a number of likely looking transformers, but none had just the right voltages. A little scrounging in a friend's junk box turned up one which did. It was center-tapped, produced about 750 volts across the winding and was large enough to gamble on its providing the needed current. It also had three filament windings which are used for the bias trans- former and the filaments. The bias trans- former is a cheap 6.3 volt filament trans- former and is run backwards off the 5 volt winding of the power transformer to produce about 100 volts.

The output high voltage of the power transformer was a little over 700 volts using a solid state bridge rectifier and the center- tap was used for the low B+ supply. Al- though theoretically the center-tap should have produced about 350 volts, this one only ran 300 and dropped under load to 285 volts . . . just about on the nose.

Fig. 1 shows that the circuit is clean and straightforward and not of unusual or new design. It should be quite easy to under- stand, even to those of us with limited knowledge. Notice the bias supply in par- ticular. This is an easy method of obtaining negative voltages and has been used in many similar circuits. The output of the reversed filament transformer is rectified by a single diode of the same type and ratings as those in the bridge network. Although I included a variable pot in this bias supply, it is not

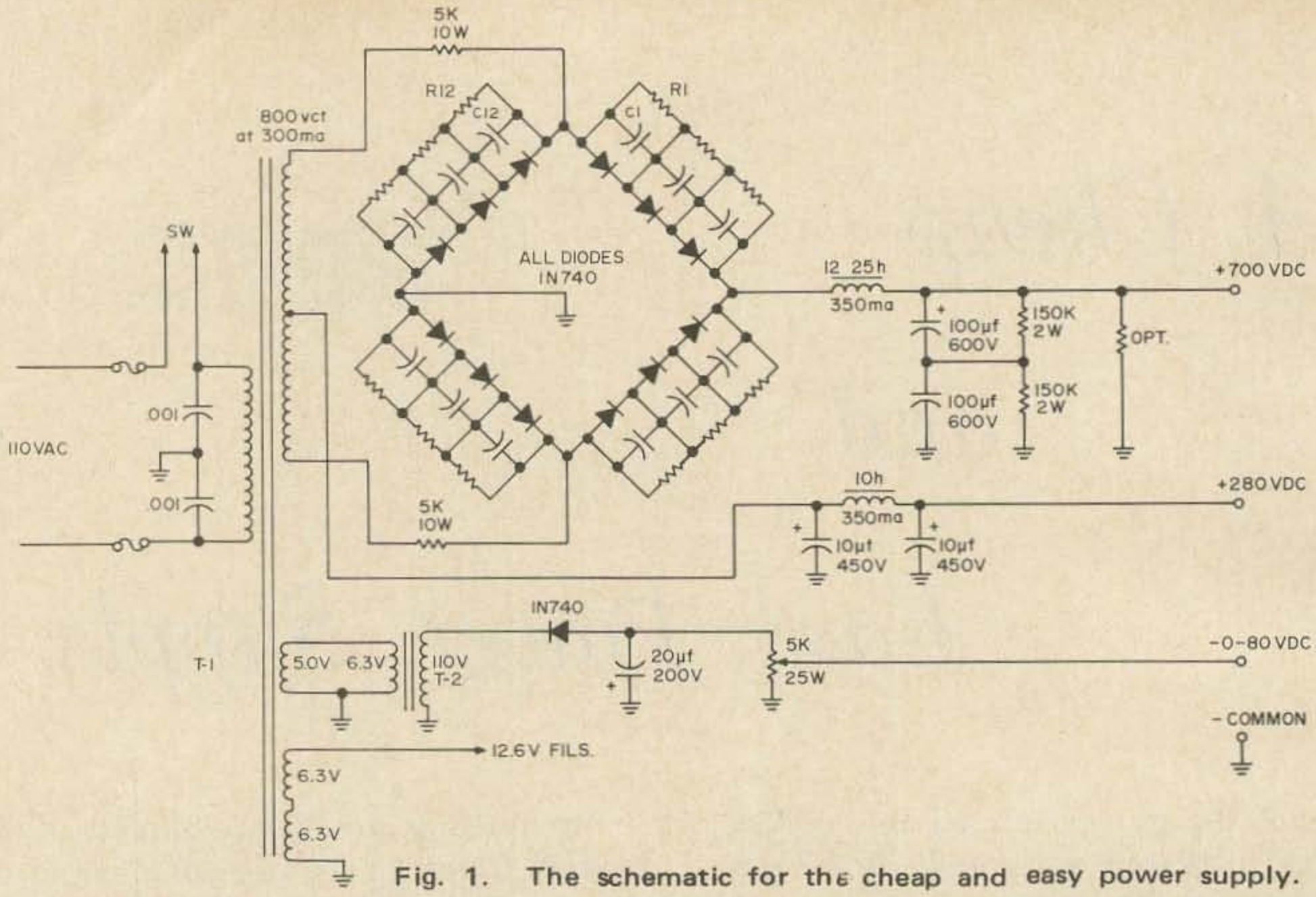


Fig. 1. The schematic for the cheap and easy power supply.

needed for the NCX-5 as it has a pot for this on the rear apron. Mine was included, since the supply is used on occasion as a bench supply. You may elect to do without it.

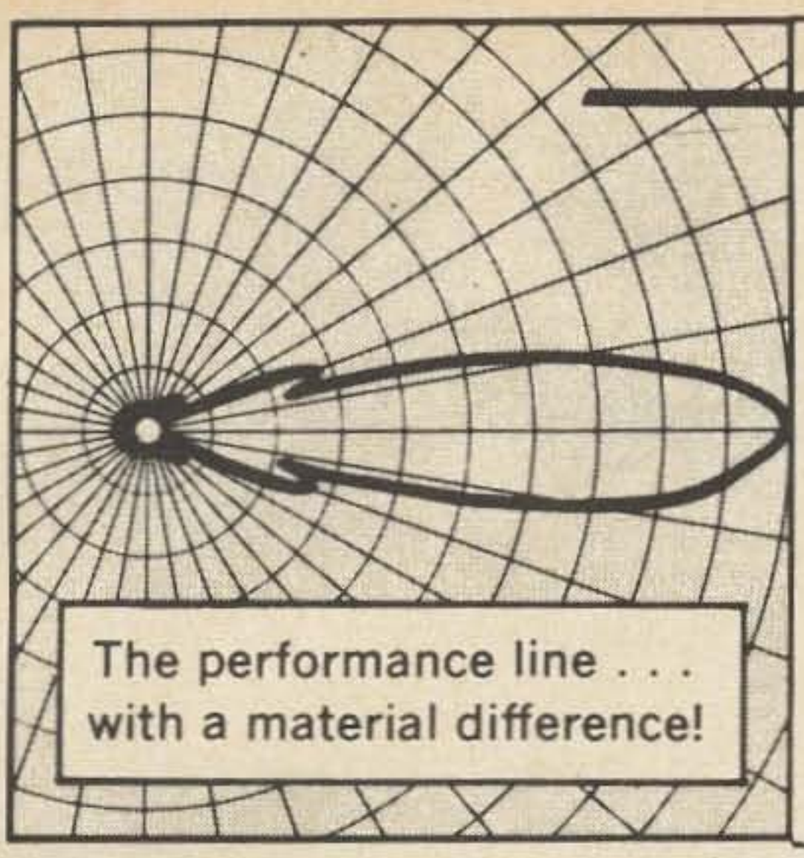
Physically the supply is small though quite heavy (about 35 pounds) due mostly to the transformer and the two chokes. It is built on a 2 x 8 x 10 inches aluminum chassis with the transformer and two chokes mounted on the top along with the bridge network. It has enough room to include the speaker if you wish. Control circuitry, filters and bias transformer are mounted under the chassis with lots of room for large fingers. All connectors are brought out one end of the chassis and include a nine pin Jones connector, an RCA phono plug for the speaker lead, the bias pot and the ac line. No switch is required in the ac line as this is done in the transceiver; however, I have one built in for bench use which is left in the on position when used with the rig (not shown on the schematic). The ac line should be fused in each leg per standard safety measures.

The heart of the unit is the diode bridge network and a few words are in order about the subject. All diodes are the top hat variety and are readily available in most local supply houses at about 50 cents each. They are rated at 400 volts PIV and 750 mil capacity. This is a full wave bridge using three diodes in each leg or twelve in all. Each diode is protected by a resistor and capacitor in parallel across it. Surge resistors are used ahead of the bridge in each leg; without them you might soon be replacing diodes.

Mount the bridge network on a small piece of Vector board about 2 x 4 inches. This board should be the type on which the lugs go through the board on both sides. Mount all the diodes on the top side of the board running around the board so that it is fed from the center on both sides. Ground and the dc will be from each end of the board. Mount the resistors and capacitors on the under side of the board making sure that they do not short across the board. Bore a hole in each corner of the board and mount on 1" stand-off insulators. Be certain that nothing shorts to ground or you will have smoke!

The rest of the supply is common sense and so nothing more will be said about it. Make a cover with Reynolds perforated aluminum and paint to match your rig. Take care so you can be proud to say that you built it. This circuit and supply is not offered as the perfect solution to your needs, however it will suffice with minor alteration for almost any modern 200 watt SSB transceiver.

I have been using this power supply for about a year now without a moment's trouble. It ran the NCX-5 for 24 solid hours



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during last field day and was cold to the touch at all times. It just recently ran the SS contest and ran cold even after a brief exchange with W2NSD/1. The transceiver can be loaded to about 60 mils over maximum so it is evident that there is plenty of current. Plate voltage under full load runs a hair under 700 volts. On the air reports are good and it has no noticeable bogies.

Total investment for all parts that the junk box did not supply came to about $18. Included among these parts were all the diodes, chassis and a filter capacitor. It's a far cry from the $110 plus tax for a commercial supply.

. . . K4FQU

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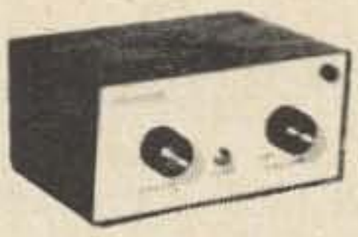

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Part IX — Modulation

73 STAFF

One factor which all forms of communications share is "modulation." While we use the word, in radio, to refer to a specific process involved in generating a signal for transmission, it's used elsewhere with much wider meanings – as for example in the phrase "he has a well-modulated voice."

Even if we limit ourselves to the meanings of "modulation" involved in radio, it's a most important subject. A major group of questions in the Extra Class license examination study list deals with various specifics of modulation – and that's our subject this time.

The FCC's study questions which we'll cover are:

1. What are sideband frequencies? During 100% sinusoidal amplitude modulation, what percentage of the average power is in the sidebands? How is the sideband power related to the percentage of modulation?

2. What do the modulation envelopes of amplitude-modulated waves with 75%, 100%, and greater than 100% modulation look like?

18. Define the deviation ratio in a frequency modulated signal.

19. What type of signal will be produced when the output of a reactance modulator is coupled to a Hartley oscillator and multiplied in frequency?

56. What is a grid-bias modulated amplifier? Should the source of fixed bias have a high or low internal resistance? Explain.

63. How are reactance tubes used?

As is our usual custom, we won't answer these six specific questions directly, Instead, we'll paraphrase them into four questions of much broader scope which will cover the details involved in the official questions.

For a starter, we'll attempt to find out "What is modulation?" After all, we can't very well examine the details of anything until we know what we're trying to examine. An adequate definition of modulation, also, may help to put the rest of our discussion into a proper framework.

Having defined "modulation," we can then ask "What can we do to a signal to modulate it?" This will sort out the various forms of modulation into appropriate groups and, along the way, will define the major classes of modulation types.

When we know *what* we want to do, the logical successor in our list of questions is *how*. That's our third one: "How can we modulate a signal?"

And finally, having seen how to produce modulated signals using any of the major classes of modulation which are in wide use by hams, we need to examine the characteristics of these modulated signals. Our last question this time will be "What are the characteristics of a modulated signal?"

We've got a lot of ground to cover to answer those four questions; we're on our way!

What Is Modulation? As we observed back at the beginning of this installment, "modulation" is a word with many meanings, and only a few of them are applicable to radio communications in general or to ham radio in particular.

For radio usage, the word has been defined many times in many ways – and then applied with some new meaning which has made the older definitions obsolete.

An example: In 1938, the Institute of Radio Engineers published an official definition of "modulation" as being "the process of producing a wave some characteristic of which varies as a function of the instantaneous value of another wave, called the modulating wave."

This definition was adequate until the rise of telemetry, in which the modulating signal is as likely to be a dc level as it is to be a "wave" (whatever a wave may be). When the modulating signal is a dc level, however, the 1939 definition must be interpreted rather liberally to be applied.

Neither does it adequately cover the concept that what we call CW is actually amplitude modulation (see last month's installment for a discussion of this idea) – and when RTTY is involved, it gets downright difficult to visualize the FSK signal as being the product of a "modulating wave"; the definition had to change.

Another definition of "modulation" is that given in the *Radiotron Designer's Handbook*, fourth edition, page 1401: "The process by which the amplitude, frequency, or phase of a carrier wave is modified in accordance with the characteristics of a signal."

This one, too, is a bit short in view of modern practice. No SSB or other suppressed-carrier signal could satisfy it, but no one would deny that a SSB signal is modulated. Neither could any type of pulse modulation qualify as modulation, under this definition.

Note that neither of these definitions cited as examples is completely *wrong*; the trouble is that they're merely incomplete – and being incomplete is an unforgivable sin in a definition.

What's needed is a definition broad enough to include not only the types of modulation used in communications today, but hopefully all future types of modulation as well. We've had to generate our own to get one that broad, but we feel that it accomplishes the goal and defines modulation in such terms that we can move on to more specific details.

Modulation, as we use the word in this installment at any rate, is the transmission of information by variation of some characteristic of a transmissible signal (which we will call the carrier) in such a manner that the original information (modulating signal) may be recovered from the result (modulated signal) by a definable process without prior knowledge of the original information.

This does not require that the carrier be transmitted as a part of the modulated signal; elimination of the carrier itself may be one of the variations used to accomplish modulation. Just so long as information is transmitted in a manner which permits its recovery, that's modulation.

Note that this definition is so broad that a conventional land-line telephone circuit or intercom qualifies as a "modulation" system. The sound waves which are the original information vary the current flow in the connecting wires; if we consider the at-rest current as "the carrier," then the change in current flow when sound strikes the microphone provides "modulation," and when the earphone or speaker changes this current flow back to sound waves, that's the "definable process" which demodulates the signal. It's hard to get much broader than that while remaining specific enought to be useful.

In practice, though, we don't deal very much with intercoms or land-lines. We're radio operators, and we deal primarily in radio signals. Our "carrier" signals, then, will most often be radio waves.

Our definition of modulation permits us to vary any characteristic of our carrier in order to apply the modulation. Let's see what characteristics of a radio signal we can vary in order to modulate that signal.

What Can We Do To A Signal To Modulate It? We've agreed that our carrier signals are, most often, radio waves, and our definition of modulation permits us to vary any characteristic of the carrier to apply modulation just so long as we can recover the original information from the modulated signal by some definable process.

So the first step in deciding what characteristics of a radio signal we can vary to apply modulation is to decide just what

characteristics a carrier has in the first place.

A conventional *rf* carrier is a single-frequency radio wave; some attempts have been made to apply modulation to non-coherent or "noise" carriers, but that's far from general practice (and no one has publicly reported any success in these attempts so far as we have been able to learn). Such a single-frequency *rf* wave has three major characteristics: amplitude, or its strength relative to some scale of measurement; frequency, or its timing relative to itself; and phase, or its timing relative to an arbitrary starting time.

In addition to the three major characteristics of amplitude, frequency, and phase, there's an even more fundamental characteristic of its existence at all. If the wave does not have the characteristic of "existence," it has no other characteristics at all. This might appear to be a merely philosophical point – and at this level of examination it is. But if we accept "existence" as a characteristic, we can then extend this idea to accept a "pattern of existence" as a special form of the "existence" characteristic; and this opens the door to the exotic forms of pulse modulation which convey information, not by the frequency or amplitude of the carrier involved, but by the patterns in which the carrier either exists or fails to exist.

We won't labor this point very much, because pulse modulation is illegal on the most popular amateur bands, and we have more than enough to attempt to cover without getting into pulse work too deeply. We must, however, note it in passing in order to be complete.

The three major characteristics which are varied in the most popular types of modulation are illustrated in **Fig. 1.**

When we vary any one of these characteristics to modulate our carrier, the resulting signal is identified according to the characteristic which we vary. If we vary the amplitude, we produce amplitude modulation or AM. Both SSB and DSB are special cases of AM, in which amplitude is varied but in addition the carrier itself (and in SSB, one sideband as well) is suppressed from the final modulated signal. If we vary the frequency, we have frequency modulation or FM. And if we vary the phase, we have phase modulation or PM.

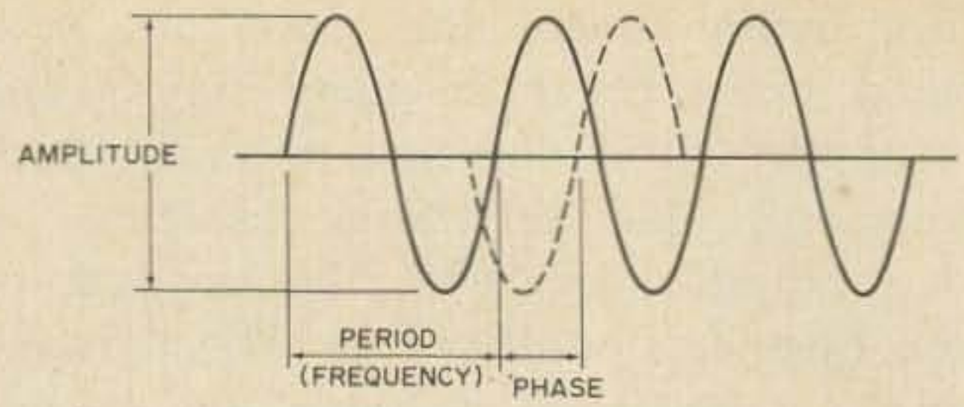

Fig. 1. The three characteristics of an ac sine-wave signal which may be varied to produce modulation are shown here. Amplitude refers to the peak-to-peak strength of the signal and may be measured in either volts or as current, so long as all references are consistent. Period is the time between two points of similarity in the waveform, such as the two zero-crossings shown; frequency is the reciprocal of period and is simply the number of cycles per unit of time. Phase is the timing between the signal itself and some arbitrary reference of identical period or frequency.

Fig. 2 shows a theoretical circuit which can be used to illustrate the differences between AM, FM, and PM. This circuit consists of an ac alternator driven by a dc motor, together with separate controls for the power applied to the dc motor and to the alternator's field coils (the power level in the field coil of an alternator or a generator controls the power level produced by the device).

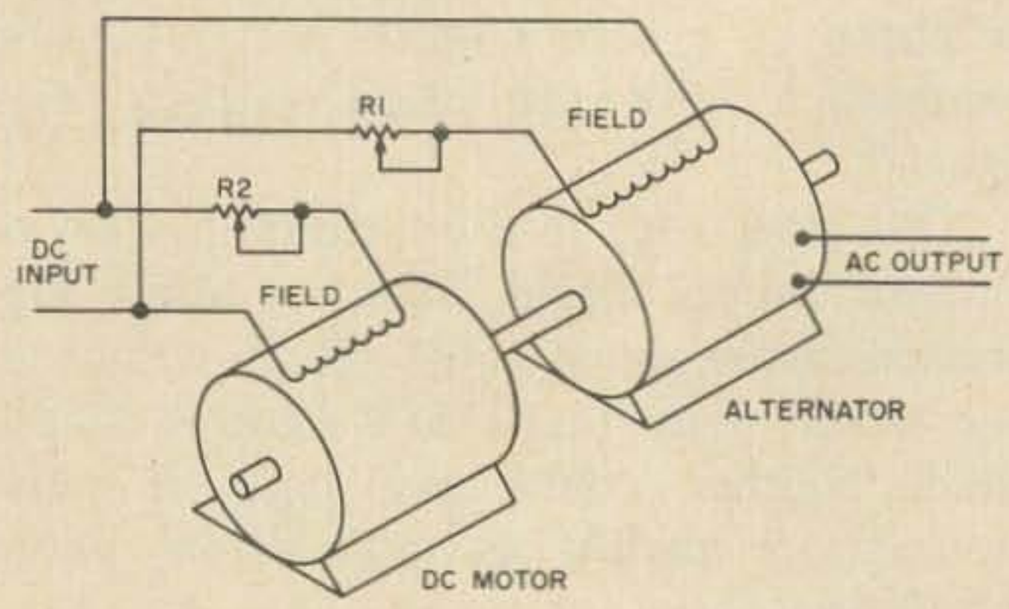

Fig. 2. This motor-alternator circuit illustrates the differences between the major types of modualtion; it wouldn't work in practice because of the inertia of the moving parts, but it gives an idea of the principles involved.

Before we use this circuit to illustrate the three major types of modulation, let's brush up rapidly on some of the most basic facts of ac power generation by means of alternators. After all, it's not one of the things we usually concentrate upon as hams.

The major difference between an alternator and a generator is that an alternator

produces ac while a generator puts out dc. This difference is accomplished by the absence of either a commutator or brushes in an alternator. Instead, the output is taken off directly through slip rings. (In practice, the "field" of an alternator is usually the rotating part, while the "armature" is stationary; this is done because a small amount of field power suffices to permit a large amount of armature power to be generated, and the designers want to minimize the amount of current which must pass through the slip rings.)

The output power level, as we mentioned a few paragraphs back, is controlled by the amount of power applied to the field winding of either an alternator or a generator.

The output frequency of a generator is always dc, but the ac produced by an alternator must have some frequency. The alternator's output is virtually always pure sine-wave in form, and the frequency is determined by the speed of rotation of the alternator's shaft. The faster the rotation, the higher the frequency produced.

Now let's look at the arrangement shown in **Fig. 2**, and imagine that the whole rotating system is so light and has so little inertia that we can change its speed of rotation almost instantly. For a start, though, let's adjust both R1 and R2 to their midpoints and take a look at the ac output. With both R1 and R2 steady, the power level and the frequency of the output will remain constant, and the signal will look like that shown in **Fig. 3.**

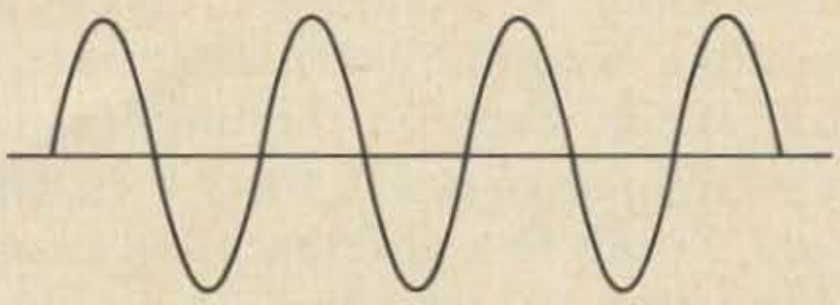

Fig. 3. If both power controls in the circuit of Fig. 2 are left in mid-position, the alternator's output will be constant in both frequency and amplitude, and will in consequence be a sine-wave signal such as that shown here. This corresponds to an unmodualted carrier signal.

Now let's vary R1 from minimum to maximum and back regularly, thus varying the amount of power applied to the field coils of the alternator and in turn varying

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the output power level, but leave R2 set at midpoint so that the signal is still of constant frequency.

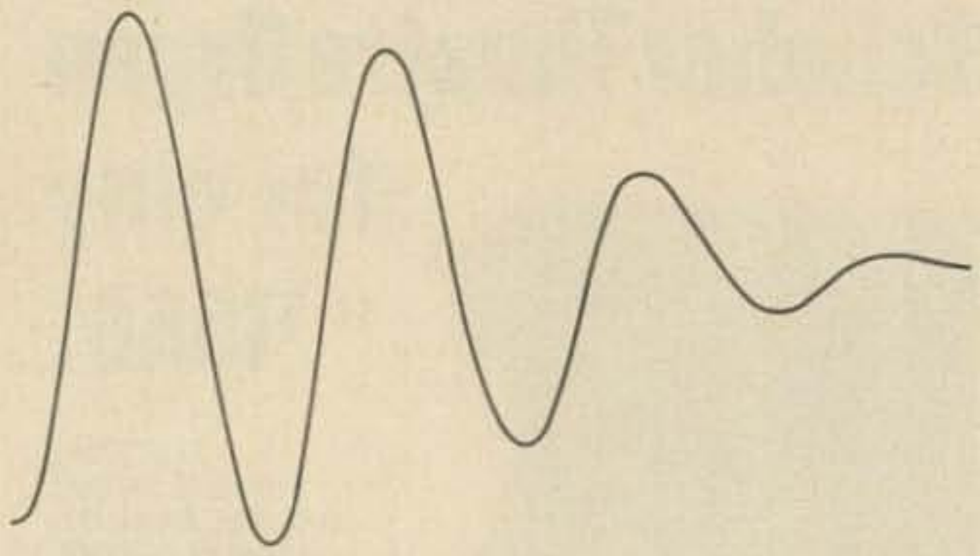

Fig. 4. If the speed control is left alone but the field power control is varied regularly from minimum to maximum and back again, the output of the alternator will be almost zero when field power is minimum and will increase as field power increases until it reaches a maximum, then fall back as field power is decreased. The resulting waveform looks like this, and corresponds to amplitude modulation of a constant-frequency carrier signal.

The result looks like **Fig. 4**. The period (which determines frequency) and the phase remain the same as in **Fig. 3**, but the amplitude varies from near zero to maximum and back down again as the field-coil power varies. This is amplitude modulation.

For the next illustration, we'll leave R1 set at midpoint so that output power level is constant, but vary R2 at the same rate as we did R1 before. Assuming that the dc driving motor can change speed instantly as we change the amount of power supplied to it,

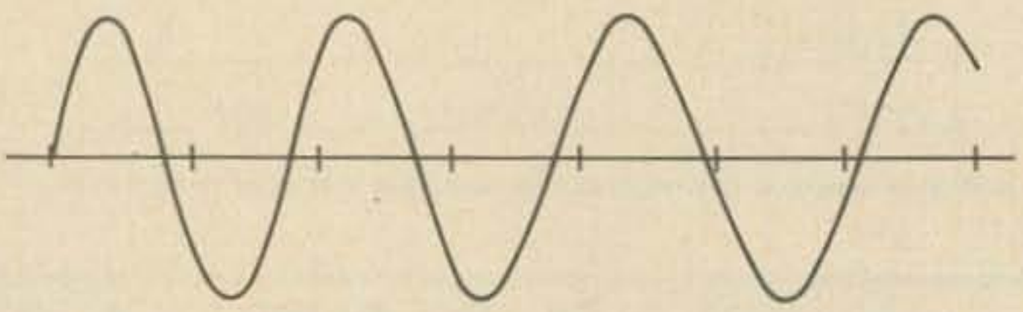

Fig. 5. When field power level is left constant, but the driving speed is varied from high to low and back, the alternator's output will be of constant amplitude but will vary in frequency. This is shown in this waveform; the tick marks on the time axis are the times at which the waveform of Fig. 3 crosses the axis, assuming that the leftmost zero-crossing occurs at the same time for boht waveforms. This corresponds to FM. All of these waveforms have been traced from an X-Y plot produced by an electronic computer, using a carrier frequency three times that of the modulating signal in order to clearly show the actions. Normal practice is to use a carrier of several hundred to several million times the frequency of the modulating signal.

and that the rotating system has so little inertia that it also can change speed instantly, our output signal in this case will resemble **Fig. 5.**

The amplitude is constant, but the period and the phase both vary as R2 is varied. The tick marks on the baseline in **Fig. 5** show where the waveform of **Fig. 3** crosses the zero axis. You can see that as the dc motor turns faster and frequency rises, the period of the output signal shortens, and as it turns

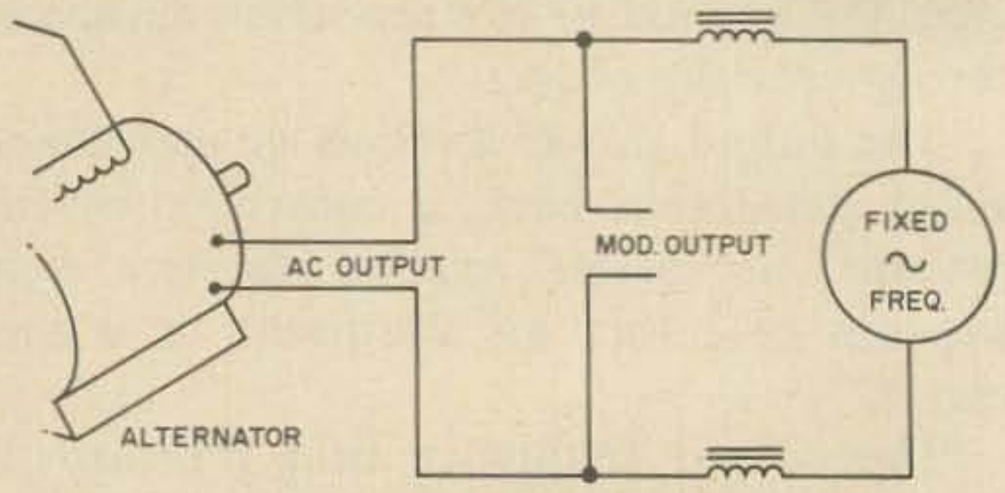

Fig. 6. If the circuit of Fig. 2 is connected to a constant-frequency generator as shown here, frequency of the output signal will be locked to that of the second generator. Varying speed of the alternator now cannot produce permanent change in frequency, but will produce change in phase of output signal while speed is changing. Result corresponds to PM, and has same waveform as FM shown in Fig. 5; differences between FM and PM are largely a matter of definitions.

slower, the period lengthens again. This is frequency modulation.

We could perform the same actions again as we did to produce **Fig. 5**, but connect the output to a fixed-frequency generator through large series inductances as shown in **Fig. 6.** When we do this, the frequency is locked to that of the fixed-frequency generator – but the phase will vary *while* the dc motor's speed is changing. This is phase modulation. We don't show a separate illustration of it, because for any single-frequency modulating signal, there is essentially no way to tell the difference between FM and PM at the output signal. The outputs of each are identical.

The functional difference between FM and PM lies in the fact that the amount of change in period or phase which occurs in the modulated signal is determined by different factors. When FM is employed, the amount of change is determined by both the strength of the modulating signal, and by its frequency. Lower-frequency modulating

signals give greater change for the same level than do higher-frequency signals. When PM is employed, the amount of change depends only upon the strength of the modulating signal.

There is no practical difference between the two types of modulation, since any filtering of the modulating signal ahead of the point at which modulation occurs can compensate for the functional difference between FM and PM, and permit an FM-type output signal to be produced by a PM modulator, or a PM output signal to be produced by an FM modulator. Most commercial FM broadcasting uses an output signal which is about halfway between true FM and true PM characteristics. Almost all commercial two-way FM equipment actually uses phase modulation, in order to permit crystal control of center frequency.

How Can We Modulate A Signal? Now that we have an idea of the basic characteristics and differences, if any, between the three major types of modulation – AM, FM, and PM – we need to know how we can modulate a signal with any of these types. The circuit of **Fig. 2** is obviously not very practical for use at radio frequencies; we need something with a lot less inertia than a physical generator, and we must be able to control it with an audio-frequency speech signal.

Let's see just what we have to work with, and go from there. If we're going to modulate a radio signal, we have some type of *rf* carrier generated by an oscillator and brought up to the output power level we desire by a series of *rf* power amplifiers, and we have some sort of modulating signal which (except for TV) is an *af* signal.

To modulate that carrier, we must change its amplitude if we want AM, its frequency if we want FM, or its phase if we want PM. Whichever of these characteristics we change, the change must be controlled by the *af* modulating signal.

We can vary the amplitude of the signal in either of two basic ways. We can vary the amount of power supplied to one of the *rf* power amplifier stages, or we can vary the operating efficiency of one of those amplifiers. This can be done at any amplifier stage, but if modulation is applied to any

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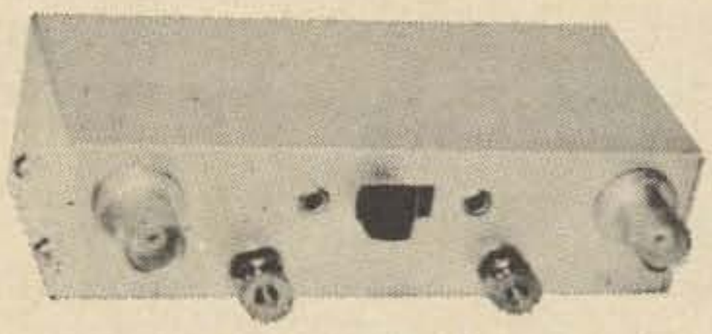

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amplifier stage except the one finally feeding the antenna, then special care must be used to keep later amplifiers from distorting the modulated signal – that is, all amplifier stages following the modulated one must be linear.

We can vary the frequency of the signal by changing the operating conditions of the oscillator which originally generates the carrier.

Phase of the signal can be varied by change of operating conditions in any of the *rf* amplifier stages, or by special processing very similar to the "phasing" techniques used to produce SSB.

This all sounds simple enough, but for each of the three basic types of modulation an almost uncountable number of different ways of doing the job has been developed. To take AM as a partial example, we can apply the modulating signal to the plate, the screen, the control grid, or the cathode of the *rf* amplifier. If we apply it to the plate, we may connect it by means of a transformer, an autotransformer, or a choke. We may also combine any of these connections. And each of these variations of AM has its own name, and its own set of rules for achieving the desired results.

Before we explore any of the more specific details of the different techniques of achieving AM, let's look at some points which all of them share in common.

To do so, we'll take two sine-wave signals; their waveforms are shown on the top two lines of **Fig. 7**. We're using a 3-to-1 frequency ratio for these signals to make the illustrations easier to draw; in practice, the higher-frequency signal normally is several thousand to several million times the frequency of the lower.

If we apply either of these signals by itself to the input of an amplifier, we will get approximately the same waveform at the amplifier's output.

If we apply both at the same time to the input of an amplifier which is reasonably free of distortion, the output will look something like the waveform shown on the third line. The higher-frequency signal "rides upon" the lower, but except for that there's no interaction between the two.

But if the lower-frequency signal is

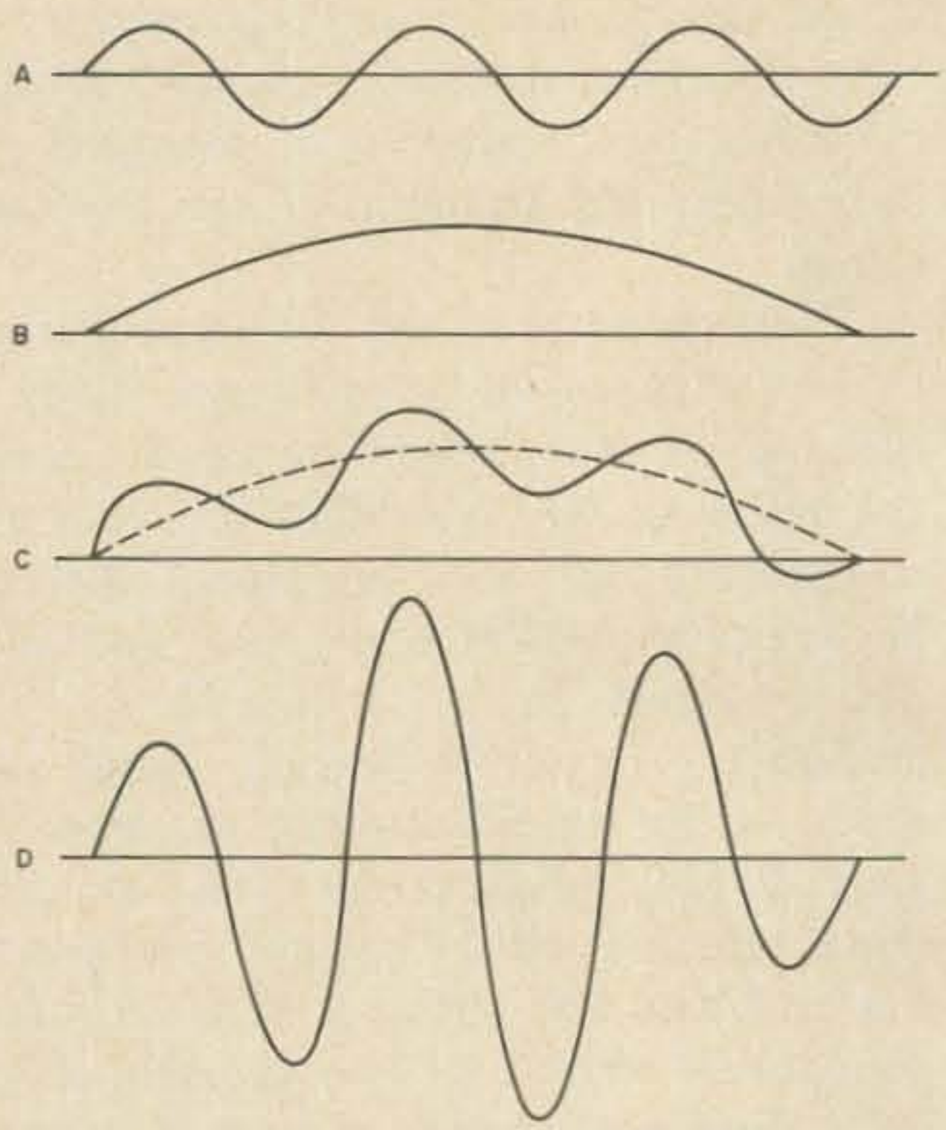

Fig. 7. These waveforms illustrate modulator action. Top line (A) is carrier signal and below that (B) is the positive half-cycle of the modulating signal. If both are applied to a linear amplifier, output waveform will be that shown at C; carrier swings about the lower-frequency waveform (dotted) rather than around the zero axis. Modulator's action is different (D); both signals swing around zero axis, but amplitude of carrier is controlled by amplitude of modulating signal. Object of AM modulation circuits is to achieve waveform shown at D.

applied to the amplifier in any manner which causes the gain of the amplifier to change as a function of that signal, and the higher-frequency one is applied to the input, then the output signal will resemble the waveform shown on the bottom line.

As you can see one of the major differences between the lower two waveforms lies in the "zero reference" of the high-frequency signal. In the bottom waveform, both the low and the high frequency signals are symmetrical about the actual zero line, but in the next-to-bottom waveform, the "zero reference" of the high-frequency signal actually is the waveform of the low-frequency one, shown by the dotted line.

A linear amplifier works to produce the effect shown on the next-to-bottom waveform; a modulator produces the bottom waveform.

Note that the requirement for producing the modulator-output waveform was that the lower-frequency signal – which represents the modulating signal – had to cause

the gain of the amplifier to change, while the higher-frequency signal – the carrier – was fed through from input to output in a normal manner.

One of the simplest ways to change the gain of any amplifier is to change its grid bias. This means that we should be able to feed the carrier to the amplifier grid as an input, and the modulating signal to the grid at the same time to vary the bias, and obtain modulating action. And, as a matter of fact, we can.

Grid-bias modulation, as such a technique for producing AM is called, has a number of characteristics which make it preferable to any other for some types of signals, as well as other characteristics which make it unattractive for general use.

Among its advantageous features is the fact that comparatively little power is required in the modulating signal; all that's necessary is a voltage swing great enough to produce the desired change of bias. Another advantage is that this technique is capable of handling a wide frequency range in the modulating signal, since no transformers are necessary. This feature alone makes it almost the only way to apply a video-frequency modulating signal to a carrier, and grid-bias modulation is the standard technique in TV transmission.

The same advantage is put to use in many receiver designs; any time a receiver uses a conventional triode or pentode as its mixer stage, with "control-grid injection" of the local-oscillator signal, a grid-bias modulator is at work.

The disadvantages which make grid-bias modulation unattractive for general AM use include its requirement for critical control of operating conditons. The variation of bias introduced by the modulating signal must change the gain in a more or less linear manner in order to satisfy the modulation requirement that the original modulating signal be recoverable by a definable process. That is, if the positive peak of the modulating signal increases gain by say 20%, then the negative peaks of the same amplitude must reduce gain by the same percentage. Otherwise the modulator's output will not be a true representation of the modulating signal, and any process for recovering the

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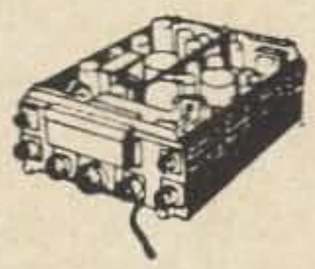

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information won't get back exactly the same signal we started with. In more conventional terms, the modulation will be distorted.

Adding to the problems of the grid-bias modulator is the fact that the modulating signal swings both positive and negative from zero, while the bias on a conventional amplifier must remain negative at all times in order for the control grid to retain control of the amplifier's action. We can take care of this by supplying a source of fixed bias, which offsets the zero reference of the modulating signal to some fixed negative voltage. Then the actual grid bias will swing from moderately negative to less negative when the modulating signal goes positive, and from moderately negative to more negative when the modulating signal takes a negative swing.

Since this fixed-bias source is electrically in series with the modulating signal, it must have low internal resistance. In fact, it must effectively be a dead short to ac signals at the lowest frequency present in the modulating signal. Grid-leak bias is not suitable; in practice, it's usually necessary to provide voltage regulation for the bias supply in order to keep the resistance low enough.

Other disadvantages to grid-bias modulation are that the modulated amplifier must be adjusted to produce only one-quarter of its maximum rated output in the absence of modulation; this is necessary because at the modulation peaks, the power output must be four times that at no-modulation levels. The modulated amplifier's grid imposes a varying load on the modulating-signal source, which can cause distortion of the modulating signal before it ever actually reaches the modulator, and the *rf* driver supplying the carrier to the modulator must be capable of supplying two to four times as much power as is normally used, again in order to supply the drive at the modulation peaks.

If a tetrode or pentode tube is used as the modulated amplifier, the modulating signal can be applied to its screen grid rather than to the control grid. Action is much the same as in grid-bias modulation, but adjustment is not so critical. Regulation of screen voltage is more customary than is that of grid bias – and in addition it's possible to achieve satisfactory screen modulation without regulating the voltages. The tolerances in screen modulation are great enough that many operators consider this the simplest and least critical type of grid modulation.

Advantages of screen modulation are circuit simplicity and the need for only a little modulating power.

Disadvantages are the need for more critical adjustment (as compared to high-level modulation which we'll examine a little later) and reduced output power capabilities.

All forms of grid modulation – grid-bias or control-grid, screen, or suppressor – are ways of varying the amplitude of the output signal by changing the operating efficiency of the modulated amplifier. Because of this, all of them must operate at below-normal efficiency in the absence of modulation, to leave room for modulation peaks when a modulating signal is applied. Most such modulating schemes operate at about 25% efficiency when there's no modulating signal, and produce their maximum rated output only during the relatively infrequent positive peaks of modulation.

It's possible to operate an amplifier at nearly its maximum rated output in the absence of modulating signal, and produce up to four times the maximum rated power during modulation peaks. We can do this simply because the modulation peaks are so infrequent that the amplifier components aren't damaged during the occasional overloads. To do this, though, we must stay far enough below maximum rating in the no-modulation or at-rest condition to permit *average* modulation levels to stay inside maximum ratings, and we must achieve our modulation by varying the supply power to the modulated stage rather than by varying its efficiency. Such a modulation scheme is known as high-level modulation, and it's the most popular form of AM in communications use.

High-level modulation is also called plate modulation, since the power variations occur in the plate circuit – but if the modulated state uses a tetrode, beam-power, or pentode tube the power to the screen grid must be varied right along with that to the plate in order to make things work.

This type of modulation requires that the

modulating signal be provided at rather hefty power levels; the modulating signal must supply half as much power as does the dc supply during at-rest periods. That is, a kilowatt amplifier that is to be plate modulated requires a modulator capable of supplying 500 watts of audio, and a transmitter operating with 100 watts input (dc) requires 50 watts of audio from the modulator.

The audio power, at audio frequency, is combined with the dc power and the result is applied to the modulated stage. One of the most popular techniques for doing this is known as "series" plate modulation and is shown in Fig. 8; the ac from the modulating

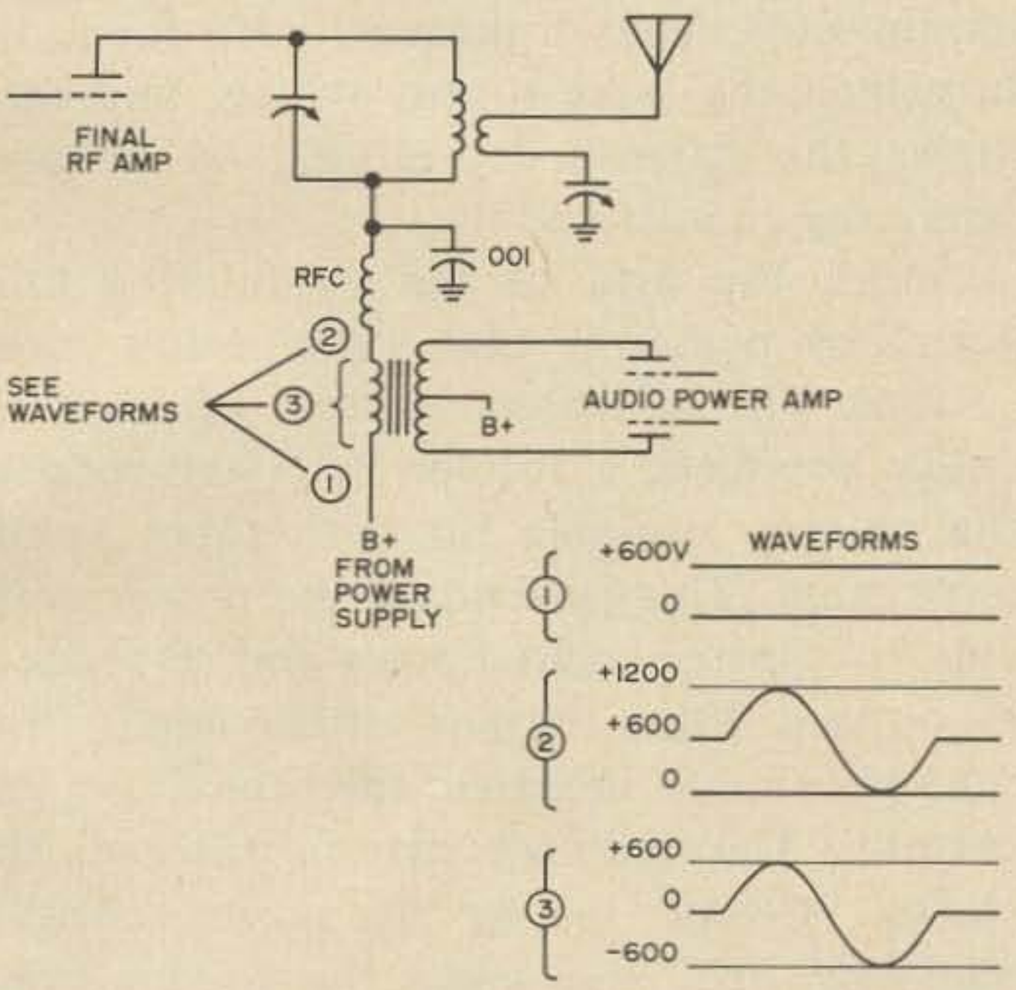

Fig. 8. Series plate modulator, version most popular among all AM modulation systems, is shown in this schematic. AC output from modulator either adds to or takes away from dc level of power supply, thus changing input power level to modulated rf stage.

signal is connected in series with the dc from the power supply. When no ac is present, the modulated stage receives the power supply's dc output with no modification. When a modulating signal swings the ac positive, the positive component of the ac signal is added to the dc from the power supply, and the modulated stage gets more power input than the power supply furnishes. When the modulating signal swings negative, though, it bucks out some of the dc from the power supply and the modulated stage gets only what's left. This reduces the power input, and so cuts down the power output.

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For such a scheme to work, the modulated stage's output power level must be determined directly by its dc power input level; the amount of input signal fed into its grid circuit must not be able to affect power output. As it happens, a Class C amplifier that is driven slightly harder than necessary to saturate it fulfills this requirement. This fact makes high-level series plate modulation exceptionally simple to adjust.

It isn't necessary to connect the modulating signal in series with the dc power input as shown in **Fig. 8**. There's another way of doing it that gets by with a little less in the way of components, but is somewhat restricted in other areas.

This alternate way is actually an older technique. Instead of connecting the modulating ac and the power supply's dc in series, we can connect them in parallel. We must place a choke in series with the dc power supply so that it won't short the ac signal to ground. The result looks like **Fig. 9**, and the technique is known as "Heising" modulation.

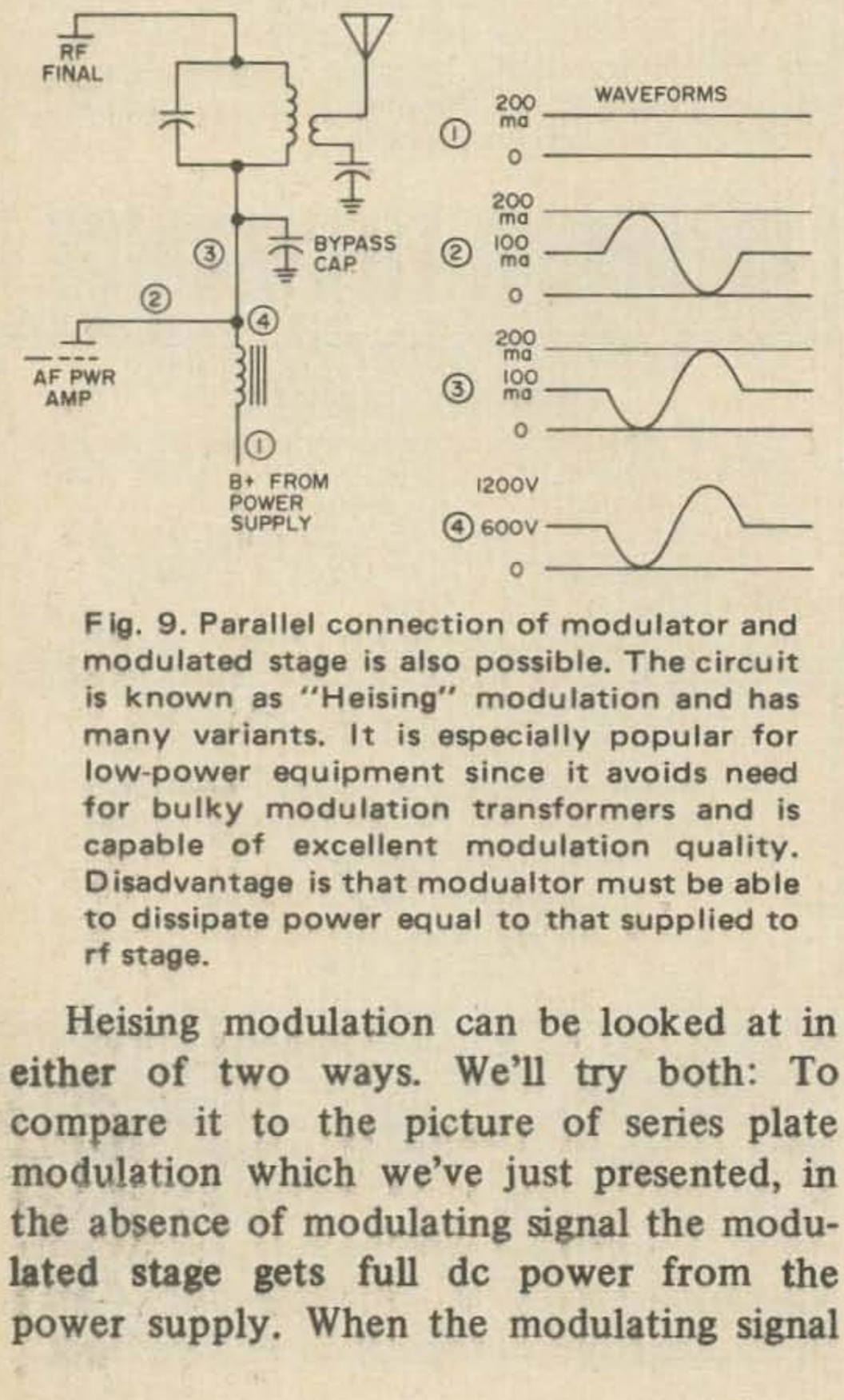

Fig. 9. Parallel connection of modulator and modulated stage is also possible. The circuit is known as "Heising" modulation and has many variants. It is especially popular for low-power equipment since it avoids need for bulky modulation transformers and is capable of excellent modulation quality. Disadvantage is that modualtor must be able to dissipate power equal to that supplied to rf stage.

Heising modulation can be looked at in either of two ways. We'll try both: To compare it to the picture of series plate modulation which we've just presented, in the absence of modulating signal the modulated stage gets full dc power from the power supply. When the modulating signal goes positive, it adds to the dc power and the series choke prevents it from affecting things on the supply side of the choke, but the modulated stage gets more dc than before. Similarly, when the modulating signal goes negative it subtracts from the power level on the modulated-stage side of the choke, and the choke prevents the supply from making the level up. Thus the effect on the modulated stage is the same as with series modulation.

The other way of viewing Heising modulation is based on the behavior of vacuum tubes. Both the modulated stage and the amplifier producing the modulating signal are fed from the same power supply, through the same series choke. When no modulating signal is present, both tubes are furnished the same supply voltage and each draws the current determined by its own operating conditions.

When the grid of the modulating tube goes less negative, that tube draws more current. The additional current through the choke produces a voltage drop and reduces the voltage available for *both* tubes at the same time. This cuts down the power available to the modulated stage and so reduces its output. When the grid of the modulating tube goes more negative, the tube draws less current. The reduced current through the choke releases energy from the choke's magnetic field and raises the voltage available for both tubes. The modulating tube has no use for the increased voltage, so the effect is to raise the power input to the modulated state, and thus increase output.

This second viewpoint indicates that a large part of the action of Heising modulation could be accomplished by using a large resistor instead of the choke – and this can be done. In low-power equipment where both space and cost are important, Heising modulation with resistor instead of choke can be used. The percentage of modulation obtained when this is done depends upon the ratio between the current drawn by the modulating tube and that drawn by the modulated tube. If the modulating tube draws less current, modulation percentage remains comparatively low. If the modulating tube draws more current than does the modulated stage, though, it's even possible

to overmodulate.

Some circuits used for screen modulation, incidentally, amount to the application of the Heising technique to just the screen of the modulated stage. A notable example is that known as "clamp-tube" modulation, which uses the Heising technique with a resistor rather than a choke.

Cathode modulation, which is sometimes employed, is a cross between grid and plate modulation, because in most amplifiers the cathode is common to both the grid and the plate circuits. It shares most of the disadvantages of grid modulation and achieves few of the advantages of plate modulation, and so has not found its way into general use.

Now that we've looked at the various ways to produce AM by varying the amplitude characteristic of the carrier, let's turn our attention to FM and PM. Since the output signals produced by FM and PM are so similar, we'll look at these types of modulation together.

We produce FM by varying the frequency of the carrier, and PM by varying the phase. However it's not possible to change the frequency of a signal without at the same time changing its phase, nor can we change the phase without an accompanying change of frequency. This makes the difference between FM and PM largely a matter of definition; the distinction normally used is that FM can be applied only to the oscillator, while PM is applied to the signal once its center frequency has been firmly established.

The frequency of any *rf* carrier is established by a resonant circuit of some sort in the oscillator. This resonant circuit may be electromechanical, such as a quartz crystal which uses mechanical resonance to produce an electrical signal, or it may be electronic, such as a normal *lc* tuned circuit. To vary the frequency, we must vary some factor in this resonant circuit.

One of the most convenient ways, today, to produce FM is to make use of the voltage-variable capacitor – a semiconductor device which acts as a capacitor, but the capacitance of which varies with the applied voltage. If one of these is included in an *lc* circuit to provide a part of the tuning capacitance, the modulating signal can be

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applied to it to change the tuning of the circuit in accordance with the variations of the modulating signal. This changes the oscillator frequency and produces FM.

The voltage-variable capacitor is a relatively recent device, however, and a more conventional method of producing FM makes use of a special vacuum-tube circuit called a "reactance modulator" or "reactance tube" to accomplish the same purpose.

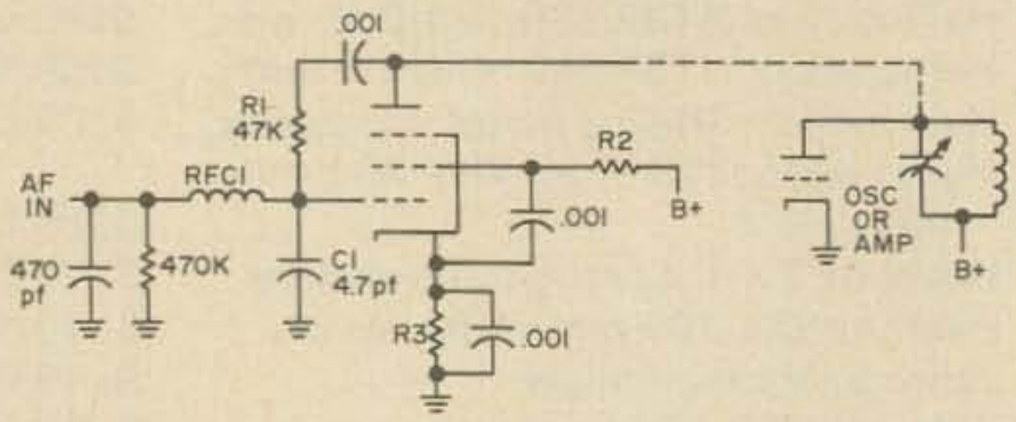

Fig. 10. Typical reactance–tube circuit is shown here. See text for details of operation.

The reactance modulator circuit, a typical version of which is shown in **Fig. 10**, depends upon the phase relationships between grid and plate voltages and currents in a vacuum tube. Under most operating conditions, the plate current of a vacuum tube is in phase with the grid voltage applied to that same tube, without regard to the phase of the plate voltage.

This means that we can place such a tube in a circuit where ac voltage is present upon the plate, and tap off some of this ac plate voltage. If we then shift the phase of this tapped voltage by 90° and feed it to the grid, the plate current will be 90° out of phase with the plate voltage.

Such a condition defines the presence of reactance in the circuit. If the current lags the voltage by 90°, the reactance is inductive, and if the current leads the voltage by 90°, the reactance is capacitive.

In **Fig. 10**, resistor R1 and capacitor C1 perform the voltage tapping and phase shifting actions, and cause the reactance in the plate circuit to be inductive.

The *amount* of reactance present depends upon the ratio of plate voltage to plate current, and the plate current is determined by the tube's transconductance (which is, in turn, determined by its grid voltage). If we apply our modulating signal to the control grid, through *rf* choke RFC1 which keeps the tapped-off plate voltage out of any earlier stages in our modulating-signal chain, we can make it control the plate current and thus change the amount of reactance present in the plate circuit.

And that's exactly what we do in the reactance modulator. The net effect is that we have a circuit which acts as either a voltage-variable inductor or a voltage-variable capacitor (to make it act as a capacitive reactance rather than inductive, we simply interchange the positions of R1 and C1 to shift the grid voltage phase 90° in the other direction). The resulting device is then connected across the frequency-determining tank circuit of the oscillator. When the reactance tube changes the reactance present in the tank circuit, the circuit is instantly tuned to some different frequency – and the exact frequency to which it is tuned is determined by the modulating signal applied to the reactance-tube input terminals.

If we connect a reactance tube, or a voltage-variable capacitor, to the frequency-determining tuned circuit of an oscillator, we can produce FM. This is not, however, the only application of the reactance tube. If we want more frequency stability than we can get with an *lc* oscillator, and use crystal control to generate the carrier, then we have to use PM rather than FM – and the reactance tube can give us that, as well. All that's necessary is to connect it across a tuned circuit in the *rf* amplifier chain between oscillator and antenna. Its reactance variations will detune the circuit to which it is connected, and this will change the phase of the signal to produce PM.

The reactance tube also finds application in some receiver circuits, to provide automatic frequency control; the combination of a reactance modulator and a self-excited oscillator is sometimes called a voltage-controlled oscillator or VCO. The VCO is the heart of the advanced receiver technique known as "synchronous detection" or "phase locked reception"; it's also a key element in a TV receiver where it helps keep the sweep signals synchronized with those of the transmitter.

Use of voltage-controlled circuit reactances such as the voltage-variable capacitor

or the reactance tube isn't the only way to achieve either FM or PM. Any practical oscillator circuit is, potentially, a frequency modulator, because the frequency of the signal it produces is affected by any change in circuit voltages. This is why we must regulate the voltages applied to the oscillator in order to keep frequency stable. If we want FM, we can simply reverse things and apply any of the amplitude modulation techniques to the oscillator itself. This will cause frequency changes which are determined by the modulating signal. The amplitude changes which result can be wiped out by overdriving the following amplifier stages, so that only FM comes out at the antenna. We can produce PM by doing the same thing to an early amplifier stage, but it's more critical.

These aren't the only techniques of achieving FM or PM; in the broadcast industry a special type of tube is often used which produces PM almost automatically, and one of the most popular ways of achieving broadcast FM is that invented by Major Armstrong and known as the "Armstrong method." It's used sometimes by hams, too, who are set up for SSB AM modulation using the phasing technique and want to produce PM as well. However, this method is based largely upon mathematical relationships and a knowledge of it isn't required in the Extra Class study questions, so we'll bypass it for now.

Neither will we examine the production of SSB, DSB, or any of the suppressed-carrier modulation techniques at this point, since they are sufficiently complex to warrant their own separate discussion in a future installment.

What Are The Characteristics Of A Modulated Signal? We've seen that modulation itself consists of any process for varying the characteristics of a carrier signal to permit a modulating signal to be transmitted, and we've looked at both the characteristics of the carrier which we vary, and at a number of techniques for varying them. How about the characteristics of the modulated signal, which results from this process?

Like the carrier, the modulated signal possesses three major characteristics – amplitude, frequency (or period), and phase.

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Unlike the carrier, though, the modulated signal never consists of only a single frequency – and so its characteristics are notably different. The difference is, in fact, what carries the information!

It's only logical to deduce from this that the modulated signal's characteristics should be strongly influenced by the type of modulation used, and they are. Because the type of modulation employed has such an effect upon the various characteristics of the modulated signal, we'll look at the characteristics as they appear with different types of modulation separately.

Amplitude modulation is still the most widely used type, and in addition we've considered it first all the way through this installment, so we'll examine the characteristics of an AM signal first and then turn our attention to FM and PM.

In our previous installment we examined the how and why of mixer action, and discovered that when two signals of different frequencies are mixed (as opposed to linearly amplified) the result is not two, but four frequencies. The two original frequencies are still present in the output, but together with them are one new frequency representing the difference between the two (and so known as the "difference" frequency) and another new frequency which is the sum of the original pair (called the "sum" frequency).

The process of amplitude modulation *is* a mixing process; any circuit which is capable of modulating a carrier frequency is non-linear, and when two or more frequencies are applied to a non-linear circuit, mixing occurs.

Thus when we apply our carrier to an amplifier stage, and apply our modulating signal to that stage also, the output of that stage must contain at least four frequencies rather than just two. If the modulating signal is anything more complex than a simple single sine-wave, as it usually is, there are many more than four frequencies present in the output.

Since the modulator does its job by mixing, the output must contain signals at each of the original input frequencies, at their sum, and at their difference.

Normally, though, a modulator is used to apply audio-frequency information to a radio-frequency carrier. In this case, the *af* modulating signal will be at a frequency so far below that of the carrier that no trace of the audio signal itself can appear in the amplifier's output circuit; it's rejected by the tuned circuits.

The sum and difference frequencies, though, are extremely close in frequency to the carrier. If we're modulating a 1-mhz carrier with a 100-hz audio signal, then the difference frequency will be at 999.9 khz and the sum will be at 1000.1 khz. These are so close to the carrier that most tuned circuits which accept the carrier will also accept the sum and difference frequencies.

Since these two new signals lie very close to, and on both sides of, the carrier, they are known as "side frequencies." The name dates from the early days of radio, before it was generally realized that modulation and mixing were one and the same effect.

When a band of many frequencies composes the modulating signal – the normal case with voice signals – then the sum and difference products alongside the carrier are no longer called "side frequencies"; instead, they are known as "side bands." Within the past several years, the two words have blended into one, and we know these parts of the modulated signal now simply as "sidebands."

The lower sideband corresponds to the difference frequencies, and the upper side-

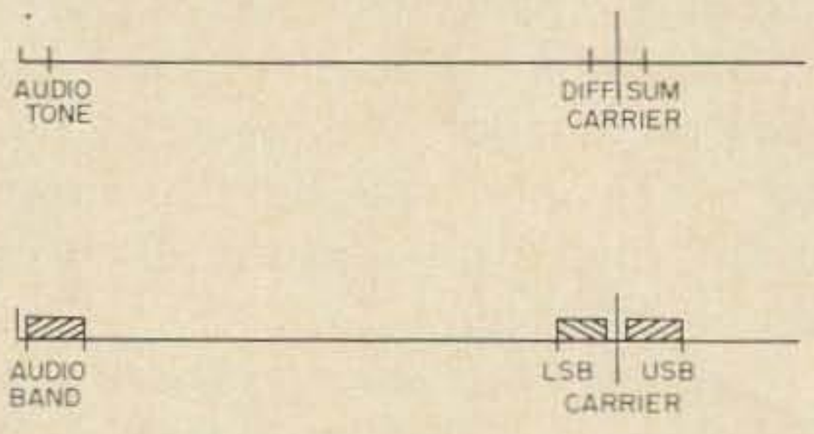

Fig. 11. Side frequencies are generated by mixing or modualtion whenever two input signals are so widely separated in the spectrum as are af and rf. Difference signal is lower in frequency than carrier, and sum frequency is higher. When an audio band, rather than a single spot frequency, is applied to mixer or modualtor, output consists of carrier and two sidebands. Lower sideband (LSB) corresponds to difference frequencies, and upper sideband (USB) to sums. Total signal bandwidth extends from lowest frequency in lower sideband to highest frequency in upper sideband, or twice the highest frequency in the original audio band.

band to the sum frequencies, produced by mixing the carrier with each component of the modulating signal. Fig. 11 shows a single pair of side frequencies (top) and a typical set of sidebands (bottom) as they might be viewed on a wide-range spectrum analyzer.

In passing, we noted in our previous installment that mixing action comes through a multiplication of one signal by the other. If each of the signals applied to a modulator (the carrier and the modulating signal) are described by their equations, the result in each case is a mathematical expression involving the sine of the amount of time since "zero time." If the two are multiplied, the trig relationships involved in multiplying one sine function by another produce an equation with one sine term and two cosine terms; the sine term turns out to represent the carrier, and the cosine terms represent the sum and the difference frequencies. All of this math was worked out in the mid-1920's – but at the time the "side frequencies" and resulting sidebands were thought to be a mathematical fiction. The experts felt that they couldn't possibly exist, but they were necessary to make the math work out properly.

Then in 1927 John Carson demonstrated the physical existence of the sidebands, and took out a patent on a system of single sideband transmission. The math was vindicated; unfortunately, it's still not an accurate picture of what goes on, because the mathematical expression fails to account for the original modulating signal.

Much later it was realized that modulation and mixing are two names for the same process (at least so far as AM is concerned), and the body of theory developed to describe mixer action was applied. Many college-level engineering texts still, however, teach modulation without going into its connection with mixing.

The references generally available to most hams, though, are even less clear, because many of them leave the impression that the amplitude of the carrier is varied to produce amplitude modulation.

In fact, we've even implied as much ourselves – and its time to correct that idea.

We saw just a few paragraphs back that the sidebands lie very close indeed to the

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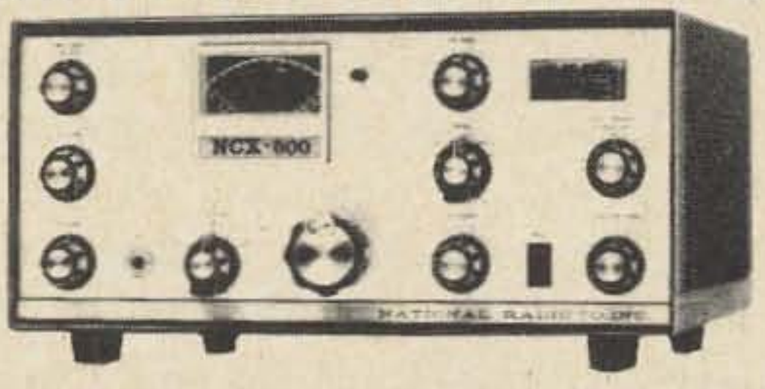

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carrier in the frequency spectrum. For all practical purposes, the two sidebands and the carrier together constitute a single signal, because most receivers are not sufficiently selective to strip out any part of this combination from the rest of it.

But when this composite signal is applied to any electronic circuit, there's only so much energy present in that circuit at any specific instant. That is, the energy present in the circuit is the net total of that contributed by the lower sideband, the carrier, and the upper sideband, all at the same time. If the energy in the sidebands is of just the right amount and polarity to completely cancel the energy of the carrier, this net total will be zero, and on the other hand if the same amount is contributed but with polarity to boost rather than buck the carrier level, the total will be twice as much energy or four times as much power as with the carrier alone.

The variations of net energy in the *total* signal produced by the amplitude and polarity changes of the sidebands relative to the carrier are called the "modulation envelope" or simply the "envelope" of the signal – and in amplitude modulation it's the amplitude of the *envelope* rather than that of the carrier which varies.

The distinction is more theoretical than practical, because as we said, it's almost impossible to separate parts of the composite out with most receivers. A "selectable sideband" receiver, though, has the ability to accept or reject a single sideband of an AM signal, and the whole art of SSB is based on the fact that all the modulation information is contained in the sidebands, and that the sidebands are mirror images of each other so that only one is necessary to carry all the information.

Fig. 12 shows the envelope of an AM signal over a half-cycle of modulating signal. This is not typical since only a 3-to-1 ratio between carrier and modulating frequencies was used, in order to permit easy vision of the relationships between net energy in the composite signal (dotted line) and the envelope (solid). Normally the frequency ratio is much higher. Like all the other waveform illustrations in this installment, this figure was traced from a plot produced by an electronic computer.

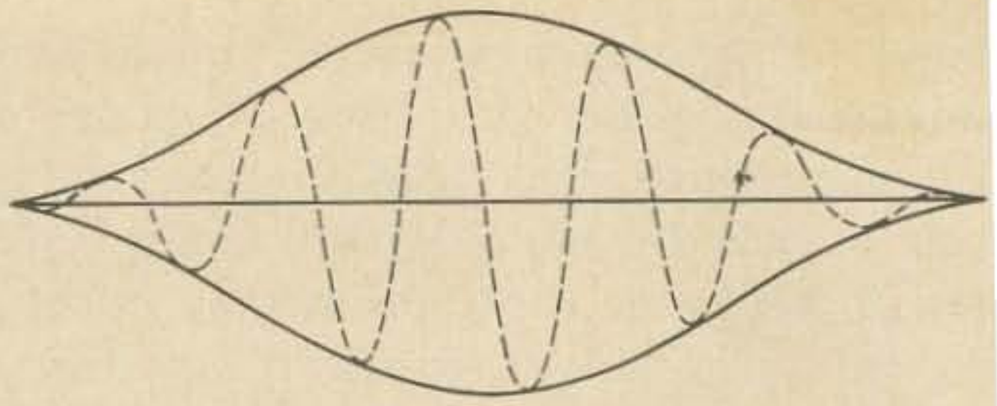

Fig. 12. Envelope of AM corresponds to the peaks of the energy levels present in the combined carrier and both sidebands (dotted waveform). This illustration shows a full cycle of modulating signal from negative peak to the next negative peak, with six cycles of carrier/sideband.

The relationship in strength between either sideband and the carrier is a measure of an AM modulation system's effectiveness. The stronger the sideband, as compared to the carrier, the more effective the system.

This relationship is usually expressed by engineers as the "modulation index" of the modulated signal, but hams and the FCC refer to it in a slightly different form called the "percentage of modulation." This, again, is a carryover from the days when only the envelope was considered – and as a result the definitions of modulation percentage make very little sense when applied to a suppressed-carrier signal, and none at all when applied to FM or PM.

For "percentage of modulation" is determined by the ratio of peak envelope voltage (or current) to the carrier voltage (or current) without modulation. Fig. 12 shows these parts of the envelope. The carrier level is indicated by the dotted line.

Percentage of modulation may be different for "upward modulation," which is the half-cycle of the modulating signal which produces the positive modulation peak, than for "downward modulation" which produces the negative modulation peak. For sine-wave modulation both are the same, but for voice the two are normally different. The larger of the two figures is customarily used as the modulation percentage of the signal.

In the case of upward modulation, the modulation percentage is 100 times the ratio of the positive modulation peak (above carrier level, as shown) to the carrier level. In Fig. 12, both are equal and the ratio is 1/1, so the modulation percentage upward is 100%.

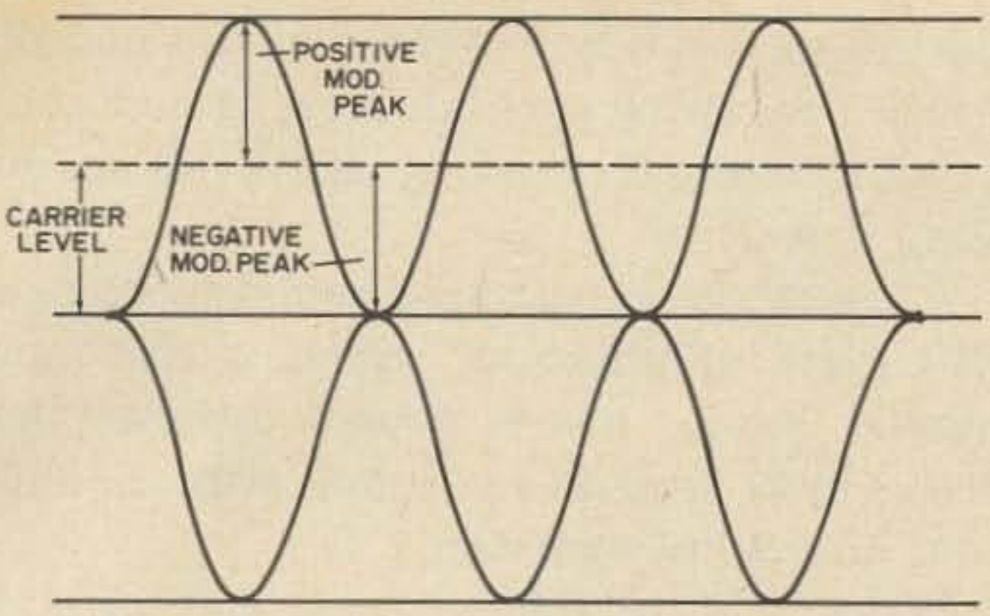

Fig. 13. Key factors involved in calculating percentage of modulation are identified here. Wave form represents 100% modulated envelope (carrier cycles are not shown) as described in text. Carrier level furnishes zero reference for envelope; envelope's outline duplicates modulating signal on both edges.

For downward modulation, the percentage is 100 times the ratio of the negative modulation peak (below carrier level) to the carrier level. In Fig. 12, again both are equal so the ratio is 1/1, making the percentage again equal to 100%.

FCC regulations limit modulation percentage of an AM signal to 100% in either direction. There's very good reason for this in the downward direction; 100% modulation justs cuts off the envelope at zero energy. Anything in excess of 100% modulation represents an effort to make the envelope less than zero; it doesn't work. What happens is that the negative modulation peaks are highly distorted, and this distortion produces spurious signals which clobber communications over a wide spread of the frequency spectrum. See Fig. 13.

Modulation percentage is relatively inapplicable to SSB or DSB, since these signals have no "carrier level" to measure against. We'll find out why it's not applicable at all to FM or PM a little later.

When you understand how modulation percentage is defined, it's not too difficult to visualize the envelope of a sine-wave-modulated signal at any prescribed percentage of modulation. Simply establish a carrier with a peak voltage of, say, 10, and then sketch in the modulating sine-wave along the carrier level. Positive peaks of the modulation envelope will rise above carrier level by the modulation percentage times the carrier level; that is, with a 10-volt carrier and 50% modulation, positive peaks will rise to 15 volts. Negative peaks will drop below carrier

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level by the same amount; in our example, to 10-5 or 5 volts.

If the percentage exceeds 100%, positive peaks still go up in the same way, but negative peaks cut off at the carrier zero reference line to produce a distorted envelope.

We have seen how all of the information content of the envelope is produced by the sidebands, in AM. We have also seen how the sideband energy levels produce the envelope of the signal. It shouldn't be too surprising to learn that all of the power furnished by the modulating signal goes into the sidebands.

Strictly speaking, that's true only of plate modulation, because that's the only type of modulation we've examined in which the input power is varied to produce modulation. But with plate modulation, that is what happens. The amplifier treats the carrier the same at all times, whether modulation is present or absent. When modulation is applied, the modulating-signal power produces the sidebands.

We also saw that 100% modulation is produced when the sidebands have just the right amount of energy to completely cancel out the carrier energy at the negative modulation peaks. Because of some rather complicated phase relationships, this occurs when each of the two sidebands has peak voltage equal to half that of the carrier. Then the two sidebands each contribute half, and the total exactly balances out the carrier.

With half the voltage in each sideband, this means that each sideband must contain 1/4 as much average power as does the carrier in order to attain 100% modulation with a sine-wave signal. To put 1/4-carrier-power levels into each of two sidebands requires that the modulator supply power equal to half that in the carrier.

Should we reduce the modulation percentage, the amount of power required in the sidebands would also be reduced. Should we use something other than a sine wave as a modulating signal, as for example normal speech, we could also get by with less power. As a rule of thumb, though, most designers try to furnish half as much audio power as there is going to be *rf* power in the carrier. This offers a safety margin, and also permits speech processing such as clipping and compression without running short of modulating power.

Because the carrier level remains constant with plate modulation, which is the most popular kind, many people believe that carrier level is always constant with modulation. This is not necessarily so.

When AM is achieved by varying efficiency of an amplifier, as is done in all types of grid modulation, it's simply the designer's choice as to whether carrier remains constant, or varies with modulation. Many designers of such systems have attempted to produce output indistinguishable from that produced by plate modulation – and in these systems, carrier remains constant.

Other designers, though, have chosen to control the carrier level. All controlled-carrier systems (a notable example is a Heathkit design originally introduced about 1955 and still current) produce carrier levels which vary with the intensity of the modulating signal.

Even in these, though, the ratio of power between carrier and sidebands remains fixed by the modulation percentage.

Now that we've given AM signal characteristics a thorough going-over, let's see how FM and PM differ.

For a starter, the envelope of an FM signal carries no information. In fact, a legal FM or PM signal has no envelope variations at all, because that would constitute AM and the rules don't permit mixing the types.

FM and PM signals do, however, have sidebands – many more sidebands than are produced by AM at the same modulation index. Most texts drop into a deep and somewhat murky study of Bessel functions when they attempt to discuss the distribution of sidebands in FM signals. Since we don't, at this point, need all that information, let's skip the details of how they are produced and simply note that the visualization most of us carry of an FM signal – a single carrier which wanders about in frequency around a "center" frequency, and whose wanderings carry the modulating signal information – is no more accurate in detail than is the conventional view of an AM signal as one whose strength varies with

modulation. See Fig. 14.

In both cases, it's the *envelope* characteristics which vary rather than those of any specific components within the signal.

This comes about because a signal of any one frequency cannot be at any other frequency – and it can't get from one frequency to another without getting to one in between first. When it's necessary to analyze in detail how a modulation system works, it's more convenient to view the signal as being made up of many signals each of specific frequency and strength, which are either present or absent, than it is to try to consider *one* signal of varying frequency or strength.

Since the advent of SSB, it's become necessary to examine AM in this amount of detail. When looking at FM, we can get by with studying only the behavior of the envelope; we don't have to break down the various components within the envelope.

The FM signal is characterized by its center frequency, strength, and the amount of deviation above and below this center frequency. The deviation may be expressed either as an absolute frequency difference in hertz or khz, in which case it's called "swing," or as the "deviation ratio," which is the ratio of the maximum carrier-frequency deviation to the highest modulating frequency. The effectiveness of the modulation is measured by the "modulation index," which is the ratio of the carrier frequency deviation to the modulating frequency. That is, a 3-khz swing with a 1-khz modulating frequency would produce a modulation index of 3; the same swing with a 6-khz modulating frequency would produce a modulation index of 0.5, and if the 3-khz swing were the maximum employed in the system, and the 6-khz signal the highest frequency, then the deviation ratio would also be 0.5.

In ham use below 52.5 mhz, the maximum bandwidth which an FM signal is permitted is 6 khz (the same as a state-of-the-art AM signal). If frequency response is limited to 3 khz, then the deviation ratio would be 2; the modulation index would vary with the modulating frequency, from 2 at the high-frequency limit up to 20 at a 300-hz modulating signal.

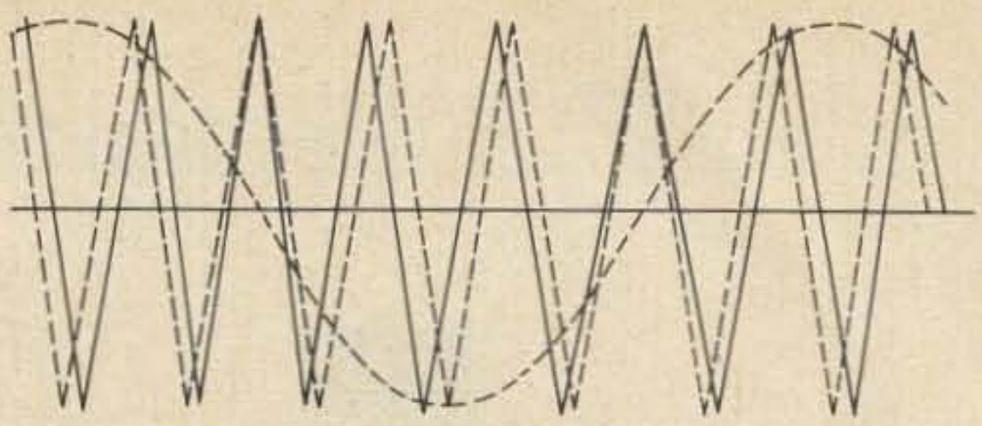

Fig. 14. This composite view shows an FM signal's waveform (solid line), compared to that of an unmodulated carrier of the same center frequency (dotted) and to the modulating sine-wave (also dotted). Sine-wave shape of carrier and modulated-signal waveforms has been simplified to straight line connecting peaks and passing through axis at proper zero-crossing time.

In AM, modulation index is the ratio of modulation peak level to average carrier level – the same quantity which we multiply by 100 to obtain modulation percentage. A 100% modulated AM signal has a modulation index of 1.0. Modulation percentage is sometimes defined, in fact, as 100 times the modulation index.

This is part of why modulation percentage has no meaning in FM work. Modulation peaks are always at the same level as the average carrier level, and by conventional definitions all FM has 0% modulation. But if 100 times modulation index is used, then the modulation percentage of a legal ham FM signal may vary from 200 up to 2000%, depending upon modulation frequencies present.

In practice, the deviation ratio is used to measure FM in the same way modulation percentage is used for AM.

But while it's possible, physically, to overmodulate an AM signal and produce splatter, this cannot be done with FM. An FM signal with more swing than a receiver is designed to accomodate will sound distorted on that receiver – but will be fine on any receiver which can handle the maximum swing of the signal. The limits on swing of an FM signal are administrative, while those upon modulation percentage of AM are physical. . . . 73 Staff

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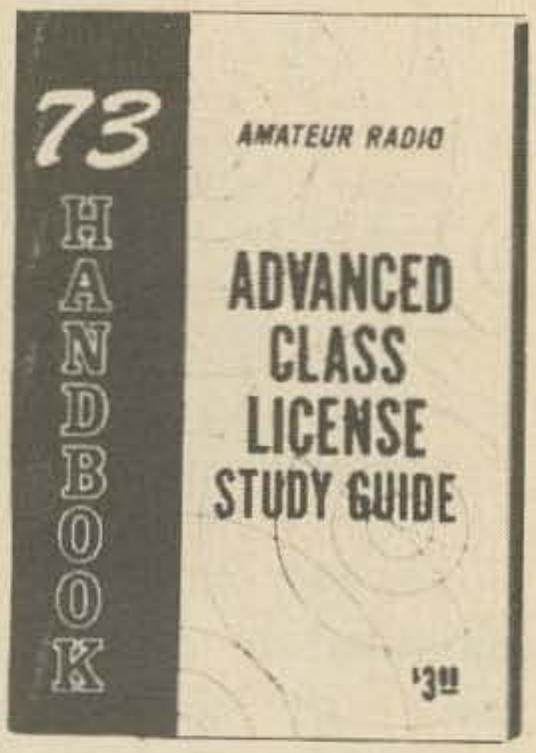
To sell Instant Gourmet kits. These unique black leather kits are filled with eight individual containers of special seasonings. A good salesman should sell 1000 of these a month, and earn a very good commission. Send your credentials to Instant Gourmet Peterborough, N.H. 03458.

73 Books for Hams

ADVANCED CLASS STUDY GUIDE



128 pages of up-to-the-minute simplified theory, written with the beginning radio amateur in mind. This unique book covers all aspects of the theory exam for the Advanced Class license and has helped hundreds of hams to sail through the exam. . .nothing else like it in print. **$3**

DX HANDBOOK

Includes giant world country-zone wall map. Articles on QSL design secrets, winning DX contests, DXCC rules, DXpeditions, reciprocal licensing and many more. World postage rates, WAZ record lists, time charts, propagation, etc. Special ham maps and bearing charts. A must for the DXer. **$3**

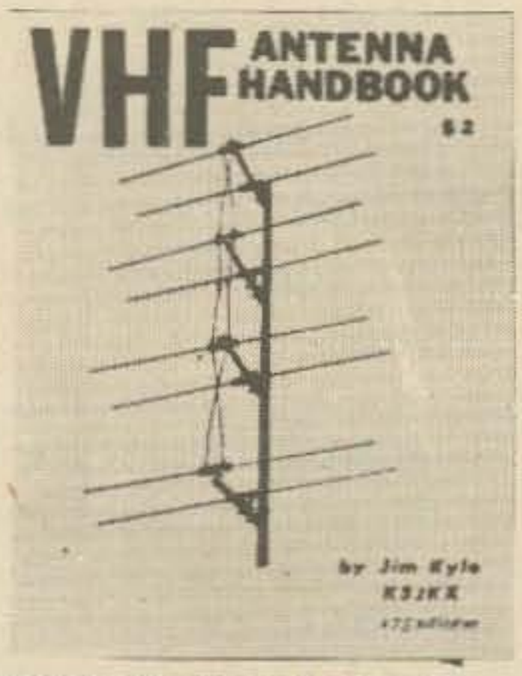
COAX HANDBOOK

Invaluable book for the ham or the lab and for everyone else who doesn't want to have to keep a whole library on hand for reference. . .or even worse, have to write to the manufacturer for coax spec. **$3**

PARAMETRIC AMPLIFIERS

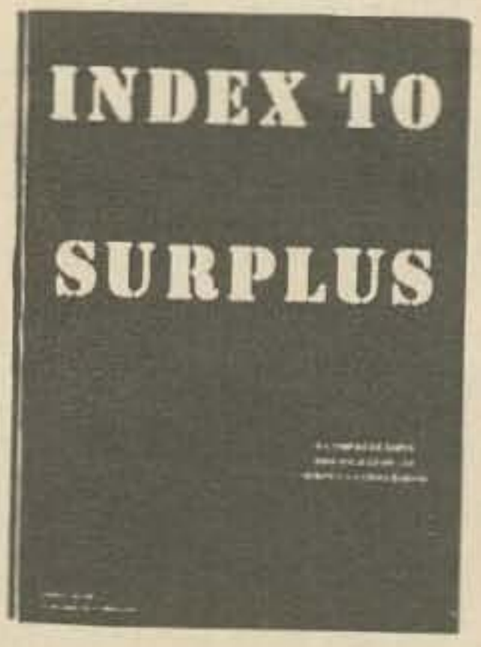
For the ham who wants to work DX on the bands about 432 MHz, there is nothing that can beat the gain and noise figure of a paramp. This book shows you how they work and how to build and use them. Lavishly illustrated with photographs and drawings. **$3**

VHF ANTENNAS



This handbook is a complete collection of up-to-date information about VHF and UHF antennas, with design hints, construction and theory. If you've been wondering what array you need, this book will give you enough background to make the right decision. **$3**

INDEX TO SURPLUS



Do you have a piece of surplus equipment that you want to convert but can't find an article? If so, this is the book you need. It lists all of the surplus articles and conversions in popular electronic and amateur magazines from 1945 to 1966. **$1.50**

DIODE CIRCUITS HANDBOOK

An invaluable reference book. Covers rectifiers, mixers, detectors, modulators, FM detectors, noise limiters, AGC, BFO'/Q-multiplier, AFC, Varicap tuning audio clippers, balanced mods, field-strength meters, RF probes, zeners, control circuits, etc. III different circuits. **$1**

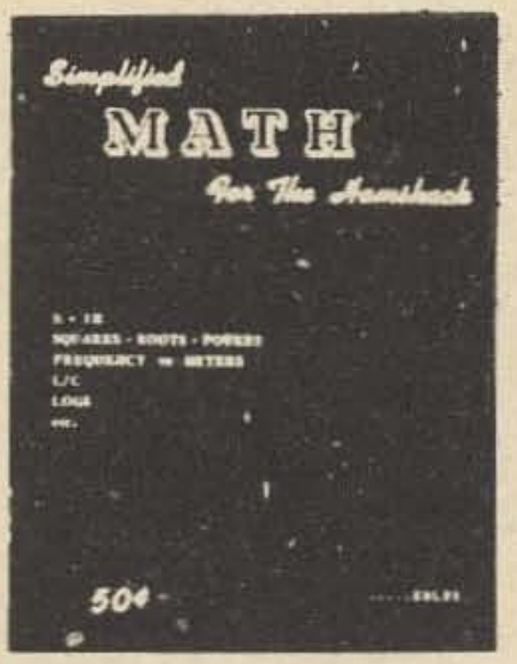
73 USEFUL TRANSISTOR CIRCUITS

If you've been looking for a transistor circuit to do a special job, chances are there is a circuit in this book that will give you a head start. It covers circuits for audio, receivers, transmitters and test equipment. **$1**

HAM TELEVISION

The Amateur Television Anthology is a collection of the technical and construction articles from the **ATV Experimenter**, edited by WØKYQ. If you're interested in ATV, this is the book for you. It covers the gamut from the simple to the complex in amateur television equipment. **$3**

SIMPLIFIED MATH



Does math scare you? — It shouldn't. This easy-to-understand book explains the simplified exponential system of arithmetic, simple formulas, logarithms, and their application to the ham shack. **50¢**

RADIO DATA REFERENCE BOOK, filled with formulas, charts, design specifications for every type of circuit, antennas, power supplies, math tables, conversion tables. Hard bound. While they last— **$3**

MILITARY SURPLUS TV EQUIPMENT by W4WKM is a necessity to the surplus-scrounging ATV addict. **$1**

CW by W6SFM explains code and how to learn it. **50¢**

CUMULATIVE INDEX lists all the articles in **73** up through December 1966. **25¢**

_Coax Handbook. $3.00
_Transistor Circuits $1.00
_Index to Surplus $1.50
_Parametric Amplifiers $3.00
_Ham RTTY. $3.00
_VHF Antennas. $3.00
_Simplified Math. . . . . $ .50
_ATV Anthology. $3.00
_CW. . . . . $ .50
_Military TV. $1.00
_Cumulative Index. . . . . $ .25
_DX Handbook. $3.00
_Advanced Class. $3.00
_Radio Data Ref. $3.00

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73 Magazine

Peterborough, N. H. 03458

Ed Gribi WB6IZF
229 Vivian Street
King City, CA

Ham Jamboree

Editor Wayne waxed eloquently in July 73 about the need for attracting newcomers into our hobby. One of the largest groups of ready-made potential newcomers are the ten million or so Boy Scouts around the world. There are a number of points of contact between scouting and amateur radio, but one of the best is the annual "Jamboree On The Air."

What is Jamboree On The Air? Let me try to describe its background, purposes, and format for you from a very personal standpoint. I had the good fortune to be one of the operators at K7WSJ, the official amateur station at the World Scout Jamboree at Farragut State Park, Idaho, in August, 1967. Those ten days were one of the high points of my 43 years. Meeting Lady Powell; the night the entire Australian contingent jammed our shack as we worked VK after VK (no third party traffic, please!); the colors of the tents and banners against the green Idaho forest; the Belgian Scout who brought his sleeping bag into the shack in the hope we could work an ON; the myriad of colorful uniforms and thousands of smiling faces thoroughly enjoying one of the great experiences of their lives. These and hundreds of other thrills and pleasant memories will always be with me. I made many lasting friendships from a dozen different countries and still exchange letters with several of them. But I was one of the lucky ones. Fewer than 1% of the Scouts are able to attend a World Jamboree or one of the greatest national or regional jamborees. Therein lies the reason for the development of Jamboree On The Air.

Scouts at Geneva, Switzerland. Operator is Len Jarrett, HB9AMS, Director of Administration, Boy Scouts World Bureau.

A number of Scouts operating the amateur station during the World Jamboree in England in 1957 were concerned that so few Scouts of the millions could actually participate in the face to face building of international friendships. Perhaps radio could extend the reach of the brotherhood and involve more Scouts, even if vicariously, in such events. Les Mitchell, G3BHK, conceived the idea of a Jamboree on the air and the first formal JOTA was in May, 1958. The idea has mushroomed with the aid and abettment of enthusiastic Scouts, Scouters, and amateurs so that now thousands of

stations from every Scouting country participate in the event every year.

The primary purpose of JOTA, therefore, is to enable Scouts everywhere to talk to other Scouts across town or around the globe by radio. A secondary purpose is to give them exposure to amateur radio which may help a boy discover a latent career in electronics or some allied field, or perhaps in amateur radio as a hobby. It has undoubtedly encouraged many a boy to work on related Scouting accomplishments such as radio and other merit badges.

The 12th annual Jamboree On The Air will occur October 18 and 19, (GMT), 1969. Participating stations with Scouts and Scouters in their shacks will be calling "CQ Jamboree" on all bands and modes during that period. There are no rules nor points to count–this is *not* a contest! The theme is to let *Scouts talk to Scouts* wherever they may be. There are no formal fixed frequencies, but the Boy Scouts World Bureau has recognized traditional operating practices by noting the following as "World Scout Frequencies":

3,590 khz. – CW
3,740 khz. – European phone, U. S. Novice CW
3,940 khz. – U. S. phone
7,090 khz. – CW, European phone
14,090 khz. – CW
14,290 khz. – phone
21,140 khz. – CW, U. S. Novice
21,360 khz. – phone
28,190 khz. – CW
28,990 khz. – phone

In addition, U. S. amateurs have found 7290 khz to be a good frequency and 7190 khz a good CW frequency for novices.

If you, as an amateur and/or Scout or Scouter are not already involved, then perhaps this should be your year for Boy Scouts. You might contact a local Scout office or executive or, even better, a Scoutmaster or Den Mother or Patrol Leader. They may not be familiar with the event unless they are avid readers of "Scouting," "Boys Life," or "World Scouting." You may have to explain the purposes and what they might reasonable expect from participation (remember, though, that propagation may not cooperate). In many areas amateurs talk to Scout Troops several weeks before the event to explain such things as how we're able to communicate hundreds or thousands of miles, typical terminology involving equipment and operating, and perhaps even to arrange a preliminary visit to a station.

During the event get your amateur operating exchanges out of the way as briefly as possible. Then turn the boys loose and let them talk to other Scouts. If they're a little tongue-tied at first, encourage them to talk about such things as themselves and their own personal involvement in Scouting; their Patrol, Troop, Post, or Den; their camping and other activities; their home, town, area, and its culture and environment; and, of course, to ask similar questions of those on the other end. Don't feel like you have to hurry off to make more contacts or to let them talk to some exotic DX Scout station. It is much more meaningful and closer to the purposes of the event to have a two-hour ragchew with a gang 100 miles away than it is to exchange signal reports with stations in ten countries. I've listened in on some marvelous QSO's during past events where, for instance, a couple of Patrol Leaders in different parts of the USA exchanged notes on their summer camp experiences or Tenderfeet talked about their first hike. On the other hand, if conditions are favorable it can be a real thrill for them to talk "live" to a Scout in some foreign country. The language barrier is no barrier when international friendship is involved.

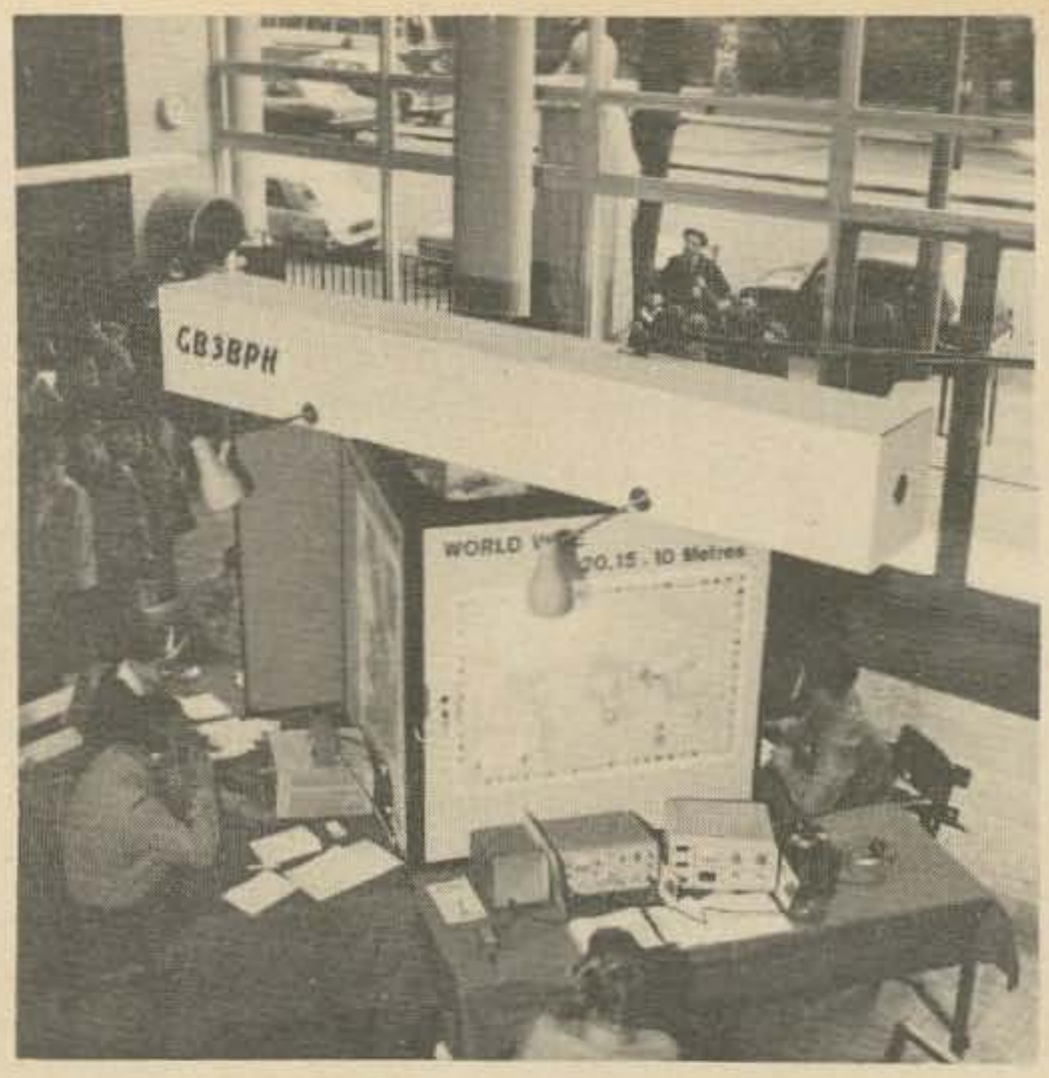
When it's all over the very least you'll have is a lot of satisfaction in having associated with a fine group of young men. I know it always restores my faith in the basic good sense of our youth whenever I get around a group of Scouts. Beyond that there are several things that can be done that will extend the interest period and firm up the relationships begun. Encourage the Scouts to make up and send QSL cards to the groups they talk to and perhaps to initiate correspondence or exchange of photos. Many permanent overseas links between Scouting groups have begun this way. And by all means send a note regarding your JOTA activities (including contacts and critique) to your National Organizer (in the United States it's Harry Harchar W2GND, Boy

Scouts of America, New Brunswick, New Jersey 08903) with a copy to the World Organizer, Len Jarrett HB9AMS, Boy Scouts World Bureau, Case Postale 280, 1211 Geneva 11, Switzerland. Len is an enthusiastic participant in JOTA's and will again this year be operating from 4U1ITU until a permanent World Bureau station can be set up. World Scout Bureau will send you a handsome QSL-sized ceritficate of participation in return for your courtesy in telling them of your own activities.

So you've done all these things but it still seems like the contact between amateur radio and Scouting-should be more than a once-a-year thing. I always have that feeling myself. There's no reason why you couldn't continue the relation with a particular Scouting group with such diverse projects as teaching them code, providing communications at a Camporee or camp, or maintaining schedules with someone contacted during JOTA. There are several nets devoted to Scouting in various portions of the world. G3BHZ and HV3SJ operate on 14290 khz on Saturdays at 0930 GMT, mostly with other European participants. World Scout Net operates on 21360 khz at 1800 GMT on Saturdays. Bob Hallock WA7GOO, is the prime mover in this group. Bob was an operator at K7WSJ in 1967 and at the National Jamboree station this last July. Bob is an Eagle Scout from Boise, Idaho. and has injected a lot of enthusiasm into the WSN. These groups are devoted to the furtherance of the ideals of Scouting via amateur radio and as such deserve support and participation by all with similar aims.

I have one suggestion regarding JOTA

Australian Scouts at VK2BW during the 1968 JOTA.



At Baden Powell House, London—English Scout headquarters.

operation this year that I haven't even cleared with Len Jarrett at the World Bureau. Let's try using these World Scout Frequencies as calling frequencies during JOTA instead of ragchew frequencies. In other words, call "CQ Jamboree" on the frequency, then QSY up or down for a QSO. That way there would be much more efficient utiltization of frequency space and much less random calling. Perhaps we could even have net control stations active on one or more of the frequencies, particularly 21,360 khz. I imagine Bob WA7GOO, could organize two or three net controls to pick up breaks, periodically call a list of stations and localities on the frequency, and help stations who wish to QSY for a chat. I'll see if something like this might be arranged by the time this appears in print. During other times these frequencies should make natural frequencies for any stations interested in Scouting to get together.

So there you have the story of Jamboree On The Air. If you're interested in young people and in the health of amateur radio, this should be a regular event for you. If you feel as I do that once a year just whets your appetite, then you might follow some of these other suggestions that could lead to a Jamboree On The Air the year round.

. . . WB6IZF

Reference:

"Scouting and the Radio Amateur," QST, July, 1967, p.52, WB6IZF

NEW PRODUCTS

Two Meter Transceiver

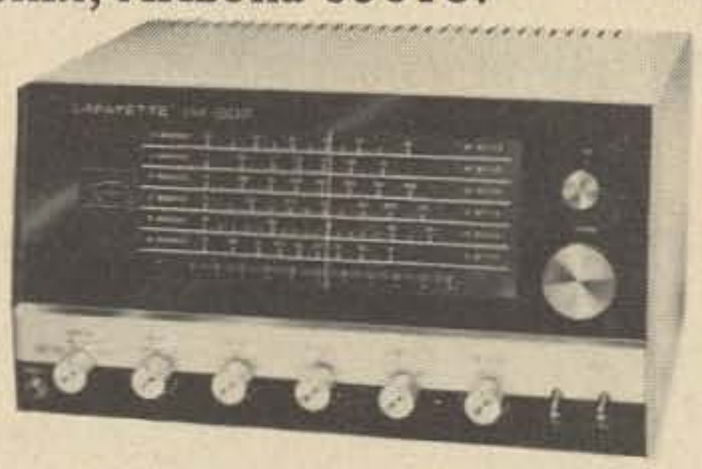
Many amateurs, tired of using older taxi and police FM equipment, have been looking for reasonably priced new equipment to come on the market. Varitronics has just announced a new solid state FM transceiver designed and priced for the amateur market. It has six crystal controlled channels and runs from 12-15 vdc. The power is 10 watts input. The unit is built with sub-printed circuit boards of the computer module type, making the unit small enough for easy portable and mobile use.

Varitronics also has a one watt output unit available which can work with a battery pack, a six meter crystal controlled FM transceiver and a dual vfo six meter AM-FM transceiver. Write to Varitronics, 3835 North 32nd Street, Suite 6, Phoenix, AZ 85018.

More Power for FM'ers

Varitronics Inc. has come out with two new linear amplifiers for users of their deluxe FDFM-2 transceiver.

For the mobile enthusiasts, the completely solid state FM-20M mobile rf linear amplifier can be had for $150.00, weighs but a pound, requires12.5 vdc and can boost your mere 2 watts to 20 watts input and 10 watts rf output. For those using the FDFM-2 transceiver as a home station, you might look into the new FM-20BM, available for $235.00. It weighs 6½ pounds, is completely solid state, has a built-in ac power supply requiring 117 vac, and like the FM-20M mobile model, can increase 2 watts input to 20. For further information, write Varitronics Inc., 3835 North 32nd Street, Suite 6, Phoenix, Arizona 85018.



Now the HA-800

Lafayette introduces the new completely solid-state, model HA-800 six-band SSB/AM/CW amateur receiver. This 80-6 meter amateur receiver has a built in dual solid state power supply permitting either 117 volts ac or 12 volt dc operation with zener regulation. The receiver section sports 3 FET's and 2 mechanical *if* filters to assure high selectivity with superior noise suppression. An S meter, product detector and crystal calibrator (less crystal) are among the other features. **Specifications:** sensitivity: better than 1 uv on 80, 40, 20 meters, .5 uv on 15, 10 meters and 2.5 uv on 6 meters; selectivity: -6db at ±2 khz, -60db at ±6 khz; intermediate frequencies! 1st *if* 2.608 mhz, 2nd *if* 455 khz; BFO frequency: 455 khz ±2.5 khz; image rejection: better than -40db; audio output impedance: 50 ohms; power requirements 105-120 volts 50/50 hz ac, 12 volts dc (negative ground); size: 15w x 9¾d x 8¼h. For additional information, write Lafayette Radio Electronics Corp., 111 Jericho Turnpike, Syosset, L.I., NY 11791.

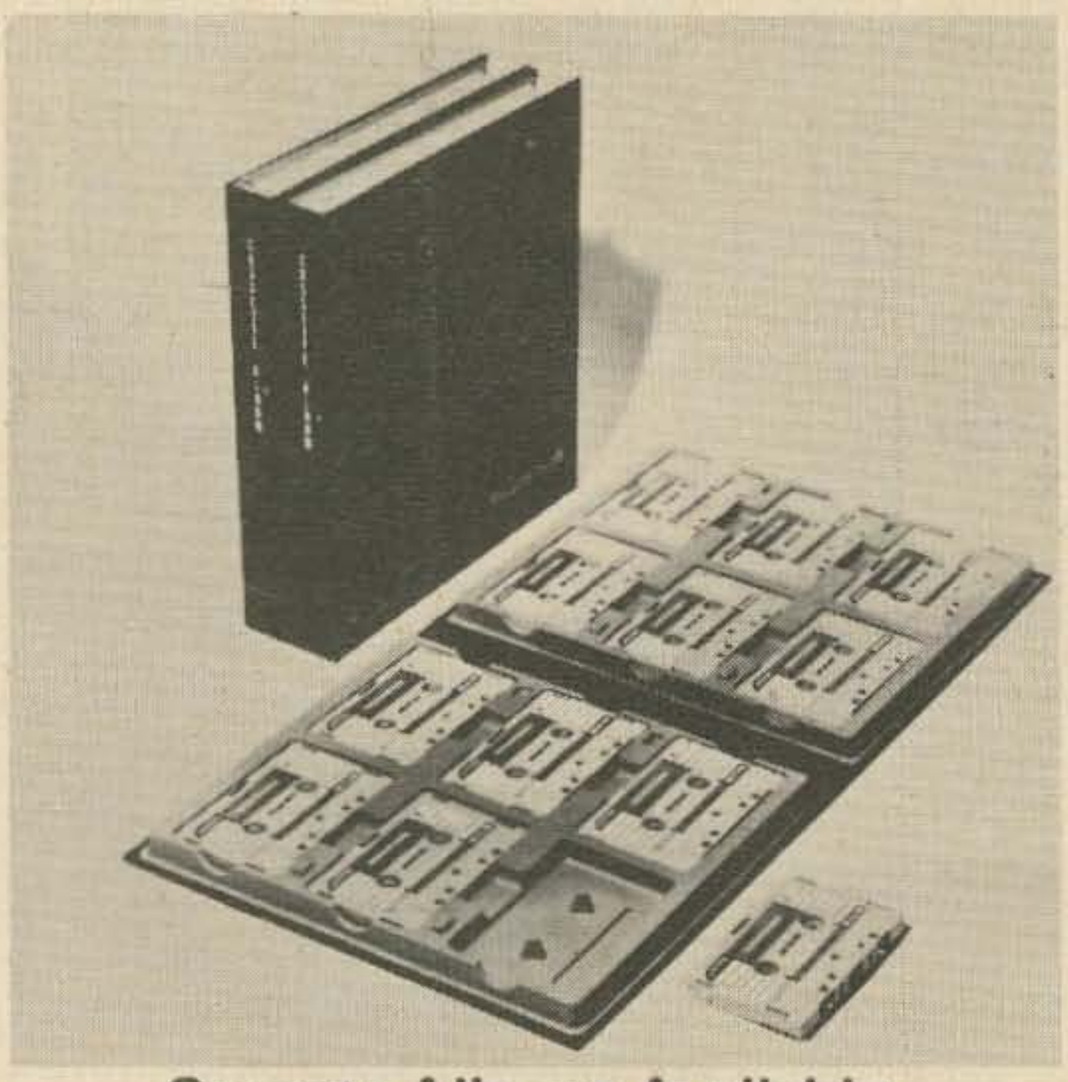
FMT-1 FM Transceiver

VHF Associates, Inc., is now offering a six channel, 5 watt input FM transceiver for $289.95. It operates with a dc input voltage of 12 to 15 volts and weighs but six pounds, being fully transistorized. IC's are used in the if and audio circuits for superior perfor-

mance and reliability and the receiver is dual conversion. The transmitter has a 20 khz maximum deviation and has a frequency range of 142 to 149 mhz. For further information, write VHF Associates, Inc., PO Box 22135, Denver, CO 80222.

Arcturus

Arcturus Electronics Corp. has been lucky enough to acquire 9800 obsolete tubes, circa 1925-1930, to add to their considerable inventory of the same hard-to-obtain types. Listings plus prices of thousands of other items are included in their recently published Mid-1969 Catalog, which they will be glad to send to you without any obligation on your part. Write direct to Arcturus, 505-22nd St., Union City, N.J. 07087.



Cassette Albums Available

Now that more and more of us are using cassette tape recorders to tape our friends and unusual DX contacts, the problem of storing those little cartridges begins to intrude. They are a terrible size to store and they soon rattle around in the desk drawer. Robins Industries, College Point, N.Y. 11356, has come out with a nice album. Each cover holds six cassettes and each compartment has a built-in stop to keep the tape from going slack! The cost is $3.30 each. A bargain.

Microflect Towers

Aluminum towers may be harder to manufacture, but they sure have a lot of advantages for the fellow who has to put

them up and use them.

First of all, of course, they weigh but a fraction of what we are used to with steel towers . . . about one third as much. A ten foot section weighs only 12½ pounds! This may not mean a whole lot to you when you are dawking it around on the ground, but when you are putting the sections one on top of the other up in the air you will bless every last pound that you don't have to struggle into place.

The weight makes an enormous difference if you have your tower hinged at the bottom for easy work on the beam and rotator. It's the difference between walking a 72 pound, sixty foot tower into place and walking a 212 pound monster into place. One man vs. maybe three to do the job.

Some towers are just terrible for climbing. Those diagonal struts hurt the feet and are dangerous if at all damp. The Microflect tower is different. Some genius thought ahead a little bit and decided that it would be a good idea to build flat step segments into each brace. The result is a tower that you can walk right up.

Aluminum towers can't rust, of course, and never need any paint. They look great when you put them up and look just as great years later.

For a catalog and prices send to Microflect, 3575 25th S. E., Salem, OR 97302.

73 Tests the Globeplotter

One of the cleverest ideas for beam aiming at DX to come along in recent times is the Megert Globe Plotter. This consists of a six inch world globe sitting up on a pedestal with a beam-path indicator.

To use this gadget all you have to do is turn the globe so that your station location is beneath the locating circle on the top of the stand. Then, as you turn the pedestal, you can read the beam heading of any city that falls under the beam-path indicator. Charts and regular world globes are all well

and good, but there is absolutely nothing like having a globe mounted with your home on its axis. For the first time you will be able to see how the great circle paths really swing...and how your signals travel. If you've ever wondered why your beam heading is almost the same for Brazil as it is for South Africa, the question will be dispelled when you swing your Globe Plotter around.

And, since the globe is not permanently fixed in place (unless you glue it to the three pillars that hold it to the pedestal) you can easily swing it around to any other location and get the beam heading from there to any other spot in the world. If a station in Germany is working New Zealand, do you think he could here you? The plotter will tell you immediately.

You don't have to scrunch over to see what the other side of the world is like...GP has a built-in mirror for looking at Australia and environs.

The Globe Plotter is just under 10" high and is mounted on a nice looking base. Price is $17.95 by mail order from Megart, Box 2097, Des Moines, Iowa 50310.

Does Math scare you?
"Simplified Math for the Ham Shack"
One of 73's books will make it easy.
Order today, only 50c.

PROPAGATION CHART

J. H. Nelson

October 1969

SUN	MON	TUES	WED	THUR	FRI	SAT
			(1)	(2)	3	4
(5)	(6)	7	8	[9]	10	(11)
(12)	(13)	(14)	(15)	(16)	17	(18)
(19)	(20)	21	(22)	(23)	(24)	25
[26]	27	(28)	(29)	(30)	(31)	

Legend: Good O Fair (open) Poor □

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21	14	7A	7	7	7	7	7	14	14A	21	21A
ARGENTINA	21	14	14	14	7	7A	7A	14A	21A	21A	21A	21A
AUSTRALIA	21A	14	7A	7B	7B	7B	7B	7B	14	14	21A	28
CANAL ZONE	14	14	14	7A	7	7	7	14A	28	28	28	21A
ENGLAND	7	7	7	7	7	7A	7A	14A	21A	21A	21	14
HAWAII	21	14	7B	7B	7	7	7	7	14A	21A	28	28
INDIA	7B	7B	7B	7B	7B	7B	7B	14	14	14	14	7B
JAPAN	14	14	14B	7B	7B	7	7	7	7B	7B	14B	21
MEXICO	21	14	14	7	7	7	7	14	21A	21A	21A	21A
PHILIPPINES	21	14	14B	7B	7B	7B	7B	7B	14	14	14B	14
PUERTO RICO	14	7A	7	7	7	7	7	14A	21	21	21	21
SOUTH AFRICA	14	14	14	14	7B	14	14	21A	28	28	21A	21
U. S. S. R.	7	7	7	7	7	7B	7B	14A	21	14	14	7B
WEST COAST	21	14	14	7A	7	7	7	7	21	21	21A	21A

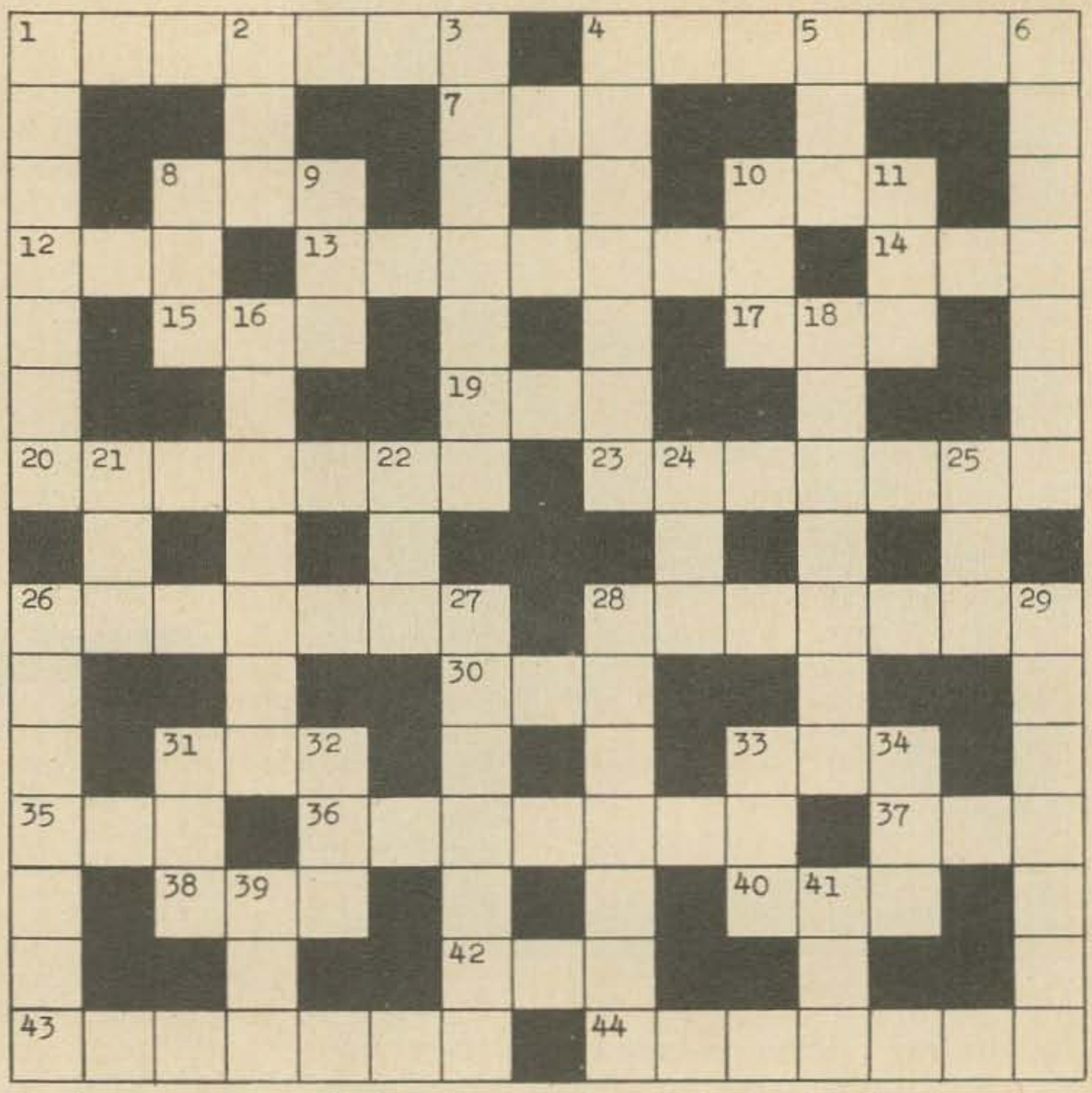
CENTRAL UNITED STATES TO:

ALASKA	21	14	14	7	7	7	7	7	14	21	21A	21A
ARGENTINA	21	14	14	14	7	7	14A	28	21A	21A	21A	21A
AUSTRALIA	28	21	14	7A	7B	7B	7B	14B	14	14	21A	28
CANAL ZONE	21A	14	14	14	7	7	14	21A	28	28	28	28
ENGLAND	7B	7	7	7	7	7B	14	21	21A	21A	14	14
HAWAII	28	21	14	7A	7	7	7	7	14A	21A	28	28
INDIA	14	14	7A	7B	7B	7B	7B	14	14	14	14	14B
JAPAN	21	14	14	7B	7B	7	7	7	7B	7B	14	21
MEXICO	14	14	7	7	7	7	7	14	21	21	21	21
PHILIPPINES	21	14	14	7B	7B	7B	7B	7B	14	14	14	21
PUERTO RICO	21	14	7A	7A	7	7	14	21	21A	21A	21A	21
SOUTH AFRICA	14	14	14	7B	7B	7B	14A	21	28	28	21A	21
U. S. S. R.	7B	7	7	7	7	7B	7B	14	14A	14	14	7B

WESTERN UNITED STATES TO:

ALASKA	21	14	14	7	7	7	7	7	14	14A	21	21
ARGENTINA	21	21	14	14	14	7A	7B	14A	21A	21A	21A	21A
AUSTRALIA	28	28	21	14	14	14	7B	7 B	14	14	21A	28
CANAL ZONE	21A	21	14	14	7	7	7	14A	21A	28	28	28
ENGLAND	7B	7B	7	7	7	7B	7B	14	21	21A	14	14
HAWAII	28	28	21	14	14	7A	7	7	14A	21A	28	28
INDIA	14	14A	14	7B	7B	7B	7B	7B	14	14	14	14B
JAPAN	21A	21	14	7B	7B	7	7	7	7	7B	14	21A
MEXICO	21	21	14	7	7	7	7	14	21	21	21A	21A
PHILIPPINES	21A	21	14	7B	7B	7B	7B	7B	14	14	14	21
PUERTO RICO	21	14	14	7	7	7	7	14A	21A	28	28	21A
SOUTH AFRICA	14	14	14	7B	7B	7B	7B	14	21	21	21A	21
U. S. S. R.	7B	7B	7	7B	7B	7B	7B	7B	14	14	14	7B
EAST COAST	21	14	14	7	7	7	7	14	21	21	21A	21A

A—Next higher frequency may be useful this period
B—Difficult current this period



Across

1. Also called a ham.
4. Electronic path between 2 or more paths providing a number of channels.
7. Type of tree.
8. Logarithmic expression of ratios of power.
10. Ampere. Abbr.
12. Electromagnetic unit. Abbr.
13. A generator that provides field current for an AC generator.
14. Organ of sight.
15. Megohm. Abbr.
17. Basic unit of work in the cgs system.
19. Period immediately before some event.
20. Surrounding.
23. Used in T.V. receivers to supply high DC voltage required by the second anode of cathode-ray tubes.
26. Chemical compound used to coat recording discs.
28. Audio amplifier frequency equal to the square root of the product of two half-power frequencies.
30. Maiden name.
31. International Radio Association. Abbr.
33. G.I. club.
35. Affirmative side.
36. A type of battery.
37. To move with pressure and friction.
38. Short sleep.
40. Surface between two adjacent grooves on a recording disc.
42. Period of time.
43. A device that introduces inductive or capacitive reactance into a circuit.
44. Process of entering information or answers via the agency of a printer.

Down

1. A means for radiating or receiving radio waves.
2. Short wires used to connect open-line wires to insulators.
3. Stepping relay actuated by an armature-driven
4. Prolonged undesirable opening and closing of elecrtical contacts.
5. Used in mechanical push-button tuning systems.
6. Speaker designed for treble frequencies.
8. Worthless person.
9. A section or branch of a component or system.
10. Unit of surface measure in the metric system.
11. A short pin or bolt.
16. End section of a transistor.
18. Also called diamond antenna.
21. Male nickname.
22. Partner of bolt.
24. Weekday. Abbr.
25. Indefinite period of time.
26. A fitting designed to change the terminal arrangement of a jack, plug or socket.
27. Sometimes called matrix.
28. Absolute unit of pressure.
29. A type of dipole antenna.
31. Atom which has fewer or more electrons than normal.
32. Snake.
33. Stations capable of direct communications on a common channel.
34. A globe or sphere.
39. Discharge of electricity through a gas.
41. Also.

. . . **Michael Kresila**

Solution on page 122

action speaks louder than words!

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Operation Cat's Paw

or The Tale of Two Kitties

I should have realized what was going on when those QSL cards would not check out with my log! My memory did not include any recollection of QSOs with those stations, and there were no entries for them in my log book.

Before getting any deeper into my problem, let me explain the W5CA station set-up. My garage-ham-shack is a Santa Fe railroad boxcar, of the old wooden type. It is 44 feet long and makes an excellent garage for my Buick. By adding a partition I made a cozy hamshack and workshop in the end of the old box car. The shack has comfortable old chairs, a battered sofa and, of course, the rig and workbench, plus the usual pile of surplus gear.

The YF and I are cat lovers and have always shared our home and household with cats. Currently we have two furry friends; Golden Nugget 3rd, and Ebony, a jet black cat two years younger than old Nugget who is twelve. Both are fine cats and friends.

Long ago, I thought up a convenient method of letting our cats in and out of their quarters. I cut an opening in an outside wall, overlaid with pieces of canvas to keep out the wind– unwanted dogs, and yet permit the cats to go in and out of their home without bothering us. Such a "cat door" was placed in the box car wall so that the cats would have a snug, warm place to sleep or to hide out. The only human access to the shack is a door that is kept locked to protect the rig from "unauthorized usage". Or, so I thought!

I practice the old habit of leaving all filaments burning on the rig and the receiver fully fired up. All it takes to get on the air is to punch a push-button switch on the table. This energizes the input to the transmitter power supplies. A foot switch, when pressed, completes the relay circuits and the rig is on the air, subject to keying. With the foot switch up, the receiver is back in action. As I said before, I should have known better!

Looking back, I recall that Nugget spent an awful lot of time in the shack. I presumed that both cats slept there at night but, even in the daytime, there was usually a cat snoozing away on the sofa or in one of the old chairs.

Nugget was also a frequent guest on the operating table. This began when he was still a small kitten. He was fascinated by the HRO dial and entranced when the colored pilot light jewels lit up. The Panoramic adapter 'scope pattern seemed to attract his attention and the wiggles of the 'scope pattern almost hypnotized the cat. He would sit by the hour and watch. As he grew older, his long whiskers would twitch as the CW screeched out of the cans perched high on my head. Ebony was not so impressed and gave the rig and its operation scant attention.

Another thing I should have noticed was Nugget's staring at the QSLs pinned on the wall and ceiling. He'd sit by the hour, golden head cocked to one side, peering at the cards with their bright numerals and intricate patterns.

Then one day I added a new one– FE1INE. Shortly after this, things began to happen that were beyond my comprehension. I have always, like most active amateurs, received a few QSLs that would not check out. Even inactive hams sometimes receive them! I'd had my share of unknowns, but now there were more than

normal. I pile up my incoming cards, and some evening when the band is dead I sort them out, check them against the log, record their receipt and then fill out answers.

This one evening there were several cards which would not fit into my records. There were the usual W and K cards, many of which were from guys so anxious to work New Mexico that they overlooked making the necessary QSO first. But there were several DX cards in the pile and they did not show up in the log. This should have been warning enough, but as I said, I was not hep– not yet!

I filed away those inexplicable cards with my collection of swl cards, sighing as I did, for there were some really rare ones in this new group of "unknowns".

A few days later our 5th call area QSL Bureau sent me another batch, and with those cards was a scribbled note from Brad, W5ADZ, our QSL sender-outer and noted DXer. His note read–"OM, you sure have some goodies in this batch. This makes me drool to see such choice morsels go out to you. What special calling formula do you use at Tijeras, or is it merely the altitude? Lemme in on the secret."

I spread out this new batch of cards which had evicted a comment from blasé Brad, who, I thought must have seen everything in the line of DX himself. No wonder Brad had mentioned *these* cards. Here is the list, just as I wrote them down on the back of a log sheet. ME0UW–UR1KAT–CA1TS– PU3SS– M0USE– YL1KIT–UP1PUS! I was sitting there mulling over these rare cards when I chanced to look over at the old sofa. Ebony was asleep but Nugget was obviously "playing possum". I could see his eyes gleam through narrowed lids. He was far from asleep.! I had been picking up the cards, one by one, examining them, and then I placed them face up on the table. Nugget looked as if he was watching me, so I tested him by holding up the colorful YL1KIT QSL. Nugget's long white whiskers twitched and I could see him drool, as cats do when they are pleased or excited about something. The look in the cat's eyes was enough to tip me off, but how dumb can we humans be? There was still another clue to the mystery but I muffed it, also. At W5CA I use an elapsed-time meter across the ac input to the transmitter plate supplies. This meter records the actual time-on-air of the transmitter. I took a look at the readings for the past few months. My figures showed that there was more time on the meter than a quick inspection tallied on the log. But, I merely made a mental note to keep better records and put down the discrepancy as lousy bookkeeping.

I continued to wonder about those "goodies" as Brad called them and regretted the fact that they could not be counted in any awards or total. I did not even recall hearing such stuff as ME0UW, although there had been some really screwy calls issued in the past few years. Yet– there was *something* that bugged me about those QSLs!

A few evenings later I got out those strange cards and spread them on the table. Nugget was sitting on the end of the operating table looking out the window. I noticed that he kept slyly turning his head to watch me lay down the QSLs. When I put down the pretty one from YL1KIT I saw a furry paw reach out and give the card a pat! The paw drew back lightning-quick as the cat obviously did not wish me to see his actions. He sat there– silently and with not a whisker twitching. Then he resumed looking out the window.

Suddenly, as it so often does, the band came alive and KA1TS came blasting in, the cans screeching out his call. The KA signed and I looked at Nugget. His eyes were open in a wicked fashion. His right front paw stiffened and reached out toward the key. The cat started to tap on the Navy knob! Shocked speechless and motionless, I just sat there. Nugget saw me stare at him and drew back his paw and began a careful inspection of the sheathed claws, completely indifferent to my bewildered glance as he took refuge in a routine cat-type operation– paw inspection.

I have been a ham for over forty years, boy and man, but what followed is the weirdest thing I ever had happen to me!

Startled, I said out loud, "I'll be–". A furry paw shot out and I heard the key click out "BK BK" as the cat manipulated the key.

Incredible thoughts raced through my brain. Could my pet understand what I say? To test him, I spoke out firmly. "Look here, Nugget! Can you understand my speech? Can you send Morse code?"

He did not hesitate. The cat's paw acted and the key clicked "C". I gasped and muttered, half to myself, "Oh, a traffic man!"

"Not me, OM" came the clicked reply, "I just know all the tricks." The cat looked smugly at me as I sat there bewildered and amazed.

As I sat there looking at my unbelievable pet he jumped from the table to the work bench where there was a transistor code practice set. He stood over it staring, until I reached for it and picked up the set and put it on the operating table. Nugget immediately moved close to the practice key and sat there– waiting.

I saif out loud, "Let's get this matter straightened out." I paused and continued. "So you understand when I speak to you?"

Then came the answer that almost rocked me from my chair. "Sure, OM. All us cats dig English." The tiny loud speaker on the code practice set rang out this unexpected reply as the cat skillfully manipulated the key.

"How long have you understood human talk?", I quickly queried the cat.

"That is the second most important thing we learn. First comes eating, and then comes language." The cat seemed very sure of himself as he pounded out the code in a precise fashion.

"Why don't you ever speak to us?" I inquired.

"We do, but you dumb clods can't hear us cats talking!" The golden-furred face bore a smirking look. I could see I was being forced into a corner, so I tried another angle of attack.

"Look here, Old Cat. What about your operating on code? Isn't that *unusual*?"

'Well, OM. I *am* getting through to you on CW. Right?"

"How about the rest of you cats?", I asked my pet.

Nugget drew himself up proudly and replied in well-sent Morse: "That is a different story. Very few cats can pound brass. Most cats are 'fone men'. If you don't believe it, just listen in on any phone band and hear all the cat-calling and squeals, especially on AM fone."

I muttered to myself, "He's got something there!" But, being undaunted, I plunged in even deeper as I queried, "How did you learn the code?"

"It was this way. You always leave the receiver going full blast. Right? And, you know how some signals just seem to drift back and forth across the dial?" I knew just what he meant.

The cat went on. "That is the way I started. I lay here trying to get some rest after a hard night out, but that CW kept whistling in my ears. I'd hear a station call. Then another would answer him. I got so I could read letters. Then came whole calls that I could catch. Finally, I got so I could copy whole QSOs." The cat stopped and looked at me, but I said nothing so he went back to his brass pounding.

"Soon as I got 'over the hump' it was easy, OM. Later I found out about tuning and happened to tune in a code practice session. Then, I listened whenever I could hear W1AW and W60WP. That is when some lid did not smother their code practice transmissions with QRM. Say? OM! Do you think I could get a Code Proficiency Certificate from ARRL?" The golden-haired puss looked up at me, with great pride in his huge yellow eyes.

"Come now! You don't think I believe that you have qualified for a CPC." I did not give him a chance to reply but pushed right on into my next question. "How did you learn to send?"

Back came a snappy answer in the form of another question. My cat was up to people-type tricks! "How did *you* learn?", he sent.

Without thinking, I replied. "Why, all us Young Squirts learned by tapping out code on a desk or table with our fingers." I looked at Nugget who did not seem impressed, so I added. "We even had QSOs that way."

"Why not?", snapped the cat. "I've tried lots of times to raise you, but OM, you sure are slow on the up beat!" Then the cat really set me back on my heels as he told me his

theory of learning the code. "Once my subconscious mind had mastered the code it was easy for it to transfer this ability to digital functions and what happened? I could pound brass as well as receive." The cat's face was full of smugness as he sat back and waited for my reply.

"Was it you, Old Cat, who ran down the batteries in the code practice set?" I asked in an accusing tone.

"Sure, I had trouble operating that little switch so I just left it on all the time."

"So– you learned to copy and to send CW. Now tell me, how did you work the rig and the receiver? What about the foot switch, Old Cat, how did you use that?"

I looked so scornfully at my cat that he lowered his head but tapped out, "Ebony was my second operator and foot-switch man."

I looked around for the black pussy cat, Ebony, but he was not in the shack. The golden-furred paw went on and continued to send flawless code to tell me this amazing story. "I tried to get Ebony to learn the code so he could operate as well as I. But he would not practice and he thought it was not worth the effort. Oh, he learned to read and to send calls, and he could even hold a simple QSO. But, let's face it. He was never a hep cat on CW."

"Tell me, Nugget. How did you work the rig? The foot switch? That takes coordination!"

"OM, I sit in front of the receiver, like this." The big cat moved over in front of the HRO and put one paw on the huge dial. This dial turned easily due to its well-worn smoothness through years of use. The cat moved the dial with practiced ease. He then returned to the practice set and sent, "That's the way I tune the receiver. Then I hit the key at just the right instant."

"The foot switch? What about that?" I implored. "How did Ebony know when to press the switch?"

"We cats have our own *private* means of communication and it sure beats electronics. Not a tube or even a transistor." The cat seemed to sneer as he manipulated the key with precisely-formed characters.

I had no reply as that comment only substantiated what I had long believed about animal communication.

The cat went on sending. "I tell Ebony when to press the foot switch and he knows from my sign off when to release it."

I had about reached the limit of my credulity and was about to blow my stack but I took one more chance and ordered– "OK! Old Cat, let me see an actual demonstration."

Nugget shrugged a whisker and replied on the key, "Why waste the juice? You know the band is dead."

I was in no mood to argue with a cat. "Never mind that. I want to see you operate. Dead band or live band. Hop to it!"

'OK, OM. If you insist. QRX one." Nugget jumped from the table and darted out the cat's door to the outside. In a few minutes he was back close-herding a reluctant, paw-dragging Ebony. The black cat crouched on the floor beneath the operating bench, obviously still half asleep. Ebony looked up at me with a mournful, resigned look. This being drafted to help operate was nothing new to him and not very pleasant either, his sad eyes implied.

Nugget said something in cat talk to his assistant operator which, naturally, I could not hear. Ebony moved over and crouched near the foot switch. There he sat, Sphinx-fashion, paw on board, waiting a command.

"Let's see you cats raise someone. Any one!" I demanded.

Nugget smirked at me, whiskers twitching, but moved to the HRO and sat up on his hind quarters. With infinite patience and considerable finesse, he slowly rolled the dial by applying paw pressure to one side. I heard a loud signal calling CQ. The paw stopped and the CQ ended. It was K9DOG. The signal was loud and clear. The cat ignored it and continued tuning over the band. Puzzled, I inquired, "Why not him?"

Nugget jumped to the practice set and replied, "OM, we cats *do* have our pride." Then he strutted back to the HRO. Tuning around he brought in another CQ and the letters of the call were C A T. The cat-operator slipped a paw and nudged the *rf* gain control. The signal rose to a more readable level and the cans rattled out the code. Nugget raised up, pressed the spotting

Micro-Switch on the vfo and, with his other front paw, carefully tuned the variable oscillator to zero beat. Then he relaxed, paw on key until the stated signed. It was K8CAT.

My two pets, by their own communication method undetectable by humans, were in contact and ready to go into action. The black puss was almost asleep, and relaxed, but at just the proper instant down went the black paw, the foot switch closed, relays clattered and W5CA was on the air! I watched speechless with amazement!

Nugget tapped out a sharp 3 x 3 call and sent AR. His co-operator under the table raised his paw, the relays snapped over into "receive" position and I heard K8CAT come back with a good report to which he added, "You must be a visitor at W5CA. That fist does not have Mid's Lake Erie swing."

I could stand this incredible sequence of events no longer so I reached for the key, just beating Nugget to the Navy knob by a whisker's width. I sent,"*This* is Mid. The other operator was my cat." I stood by. There was a long pause---

"Did you say your c,a,t?" inquired the distant 8.

"Yes, OM." I repeated, "my cat." I looked over at Nugget who was now engaged in a microscropic examination of his left paw. He showed only indifference on his golden face. I looked down at the black cat, Ebony. He was still crouched at the foot-switch with a paw in the "ready" position.

K8CAT was still unconvinced as he asked, "You mean a feline animal? A pussy cat?"

This time Nugget's paw beat my hand to the key and he replied, "Sure—a cat. I am twelve years old, name is Nugget. I have a golden coat and a long fluffy tail. BK."

There was a vast quiet on the frequency. Then came a stuttering sound of characters incoherently formed. Finally the dots and dashes dribbled off into gibberish. Then—more silence and lots of it!

Nugget looked at me and I am sure he shrugged his whiskers. His look said-well, that guy just could not take it. The cat seemed unmoved by the distant amateur's confusion.

I reached for the log book to record the ill-fated QSO with K8CAT. That action brought back a flood of memories and raised some pointed questions in my mind. What about those uncheckable QSLs? Such an event could have brought in QSLs from those "unknowns".

Then the shack roof fell in on me! MEØUW—MØUSE and YL1KIT! Could it be that my cat operators were *that* selective?

The golden cat moved over to the practice key and resumed our cross-band QSO in his excellently-sent code. "Only the good DX. Ebony worked some of the locals. He does not dig DX like I do. Besides, he has a lousy fist-I mean *paw*. I don't let him operate often."

I glanced at Ebony but he appeared to be sound asleep. Perhaps he was and had not heard Nugget's slanderous remark, or perhaps the code was just a bit too fast for him.

"Perhaps, OC," I continued, "you would care to tell me how you learned about DX and what *is* choice DX?" My voice was more respectful as the awsome facts began to sink in.

"I read QST's 'HOW'S DX'. You always leave the magazine open at that page, OM" sent my intelligent pet.

"Now, Nugget!" I said with triumph in my voice. "I've got you! It takes a magnifying glass to read that fine print in QST."

"BK—" sent the cat, "you know that us cats are very proud of our keen eyesight. Why, OM, I can even read the addresses listed in the *call book*!" Nugget was really smirking now.

That did it! I realized that this discussion, while enlightening, was not placing human beings in a favorable light. I leaned down and picked up the sleep-limp Ebony. I placed him by the practice key and said, "Let's hear your fist, Ebony!"

Nugget must have said something to Ebony. The little black cat put out a stiff paw and slowly tapped out in uneven characters—"Ur s igshere 5 59Q T HTijer as Ne w Mexic o handlehereEbony how cpyb k toyou." Ebony relaxed in a heap beside the key.

Nugget shot out a paw and sent briskly, "You see what I mean, OM He has listened to and worked too many Novices." The

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golden-furred cat seemed almost ashamed of his companion's inept operating skill. "But", the sending continued, "he is really a sharp foot-switch man."

I was chagrined at all these proceedings but yet I was determined to add some reproachment for the cats 'actions. "Look here, you furry scoundrels. What about FCC regulations regarding 'unauthorized operations'? What about Rule 12.1?"

Nugget broke me on the practice key and replied. "You mean where it defines an 'amateur' as a person interested in radio technique? The FCC cannot bother us cats. Cats are not persons!"

I could think of no fitting response to that obvious truth so I pressed on to another point. "How come you never filled in the log or answere any of those QSLs?" My questions were almost a sneer.

Nugget's reply was the coup de grace as he snapped back. "Who ever heard of a cat who could *write*?"

. . . W7ZC

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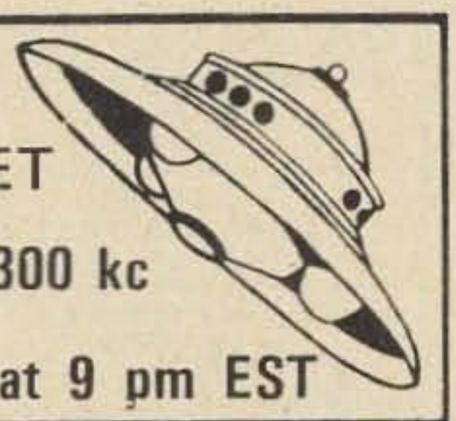

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Save That Manual

Every ham who has been actively associated with the hobby for any appreciable length of time has around the shack a multitude of rigs, rotors, and test equipment which requires occasional maintenance of one type or another. When the equipment was new, the last thing on the owner's mind was a future need to refer to the instruction and/or service manual. All too often it is tossed into a corner and forgotten. Comes the day service is necessary or a sale imminent and the manual is not to be found.

One excellent way to keep this valuable information at your fingertips is to place all such data in a three-ring notebook (three-ring because smaller manuals will still be held by two of the rings). The dime-store variety binder will do nicely. While there, also buy a set of inexpensive dividers, and label each with a type of equipment. Having separate sections for the various types of equipment will speed your progress when you need a particular manual.

A second method, which I find to have advantages, is to buy a separate folder for each piece of equipment. The cardboard type with three double metal tabs is available at your local stationery store in various colors. In this shack red indicates transmitters, black is test equipment, grey is antennas, rotors, and other outside hardware. A typed, gummed label on the cover indicates the exact contents. These folders may be neatly kept on a bookshelf where they will be easy to find. The uniform size and the color coding make the shack take on an air of neatness which could well become contagious. **William P. Turner, WAØABI**

Solution to puzzle on page 114.

1 A	M	A	2 T	E	U	3 R	■	4 C	I	R	5 C	U	I	6 T
N	■	■	I	■	■	7 A	S	H	■	■	A	■	■	W
T	■	8 B	E	9 L	■	T	■	A	■	10 A	N	11 P	■	E
12 E	M	U	■	13 E	X	C	I	T	E	R	■	14 E	Y	E
N	■	15 M	16 E	G	■	H	■	T	■	17 E	18 R	G	■	T
N	■	■	M	■	■	19 E	V	E	■	■	H	■	■	E
20 A	21 M	B	I	E	22 N	T	■	23 R	24 F	P	O	W	25 E	R
■	A	■	T	■	U	■	■	■	R	■	N	■	O	■
26 A	C	E	T	A	T	27 E	■	28 M	I	D	B	A	N	29 D
D	■	■	E	■	■	30 N	E	E	■	■	I	■	■	O
A	■	31 I	R	32 A	■	C	■	G	■	33 N	C	34 O	■	U
35 P	R	O	■	36 S	T	O	R	A	G	E	■	37 R	U	B
T	■	38 N	39 A	P	■	D	■	B	■	40 T	41 A	B	■	L
E	■	■	R	■	■	42 E	R	A	■	■	N	■	■	E
43 R	E	A	C	T	O	R	■	44 R	E	A	D	O	U	T

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Knight V-107 VFO for Six and Two Meters

Ralph Steinberg K6GKX
110 Argonne Avenue
Long Beach, CA 90803

Just finished the Knight-kit V-107 VFO and it took me one hour to do it. Would you believe two hours? Honestly it took me three hours by my stop watch to assemble, wire and calibrate this VFO. Time was not essential, but I was anxious to see how long it would take to complete the kit and have it operating.

Assembling the Knight-kit V-107 VFO is so simple that any previous experience is not necessary. The instructions in the manual make every step of construction easy to follow. The text and pictures show exactly where each wire or component fits in. Yes, the wires are even cut to length, stripped and ready for soldering. If you are not an expert on soldering now, there are some excellent lessons in the construction manual which will make you one.

The V-107 VFO is usually sold as an accessory for the TR-106 and TR-108 Knight-kit Transceivers but it can be used with any 2 or 6 meter transceiver or transmitter. It uses the Clapp oscillator (sometimes known as Colpitts) for maximum stability and has a high L/C ratio in the tank circuit, resulting in less drift. The output of the VFO has a minimum of 20 volts RMS which is enough to drive most any transmitter for the 2 and 6 meter bands. A high-gain pentode, 12BK6, is used for the oscillator tube and a voltage regulator tube, OA2, is used to stabilize the voltage on the screen of the 12DK6.

Calibrating the V-107 is no problem if the step-by-step instructions are followed in the construction manual. You will find it just takes three important adjustments, L-1, L-2 and C-2, to calibrate the VFO for either 2 or 6 meters. With these adjustments finished you are ready to work anybody on these bands and be on frequency of any station. It might be suggested that these calibration adjustments be made after a thirty-minute warm up to make sure they are correct.

Power requirements are 200 volts DC at 30 ma and 12.6 volts AC at 150 ma for the 12DK6 oscillator tube and can be supplied from the TR-106 or TR-108 Knight-kit Transceivers. Should the VFO be purchased separately, power can be taken from the transmitter or transceiver of your choice. An outboard power supply with the same voltages will do as well.

When the V-107 VFO was finished, "on the air" workouts were done to check drift, temperature and mechanical stability. On drift it was minor and in line with the specifications of the manufacturer, Allied Radio Corporation. For temperature, it was cool as cucumber and this is due to power levels kept at a minimum allowing for very little heat dissipation. The mechanical stability can be said that the V-107 is rugged and designed like the well known expression . . . "just like a battleship."

Two different 2 meter transmitters were used for checks on this VFO and in each case there was plenty of drive and it operated the "rigs" satisfactorily. Much of this was due to keeping the output cable of the VFO short, as recommended in the construction manual.

For the ham that has just a few crystals to operate on the 2 or 6 meter band, the Knight-kit V-107 VFO just cannot be beat at the price of $24.95.

. . . K6GKX

Technical Specifications

Frequency coverage: 8.333 to 8.666 mhz for 6M; 8.000 to 8.222 mhz for 2M.
Frequency stability: +/-500 cycles per hour after 30 minutes.
RF output: 20 volts rms minimum into 47K/30 pf.
Power requirements: 200 vdc @ 30 ma; 12.6 vac @ 0.15 amp.
Tube compliment: 12DK6 oscillator; OA2 voltage regulator.
Cabinet size: 5½" x 4-5/16" x 6½".

Careers in the FAA

Sam Kelly W6JTT
12811 Owen St.
Garden Grove, CA 92641

Looking for a way to combine a career in electronics with adventure and above average earnings? Want exciting work on a tropical island, a tracking ship on the high seas or in Europe? If so, you should look into the opportunities in field service.

Field service (also called field engineering) provides technical support and operating personnel for equipment after it has left the home plant. As you can guess, the U. S. Government is the biggest customer for electronics equipment and field services. The government needs technical help to keep the vast amounts of electronic equipment associated with our space programs and weapon systems operating.

Besides private industry, many branches of the government operate their own field service organizations. An example is the Federal Aviation Agency (FAA). The FAA maintains an excellent field service organization that performs such widely diversified tasks as making radar surveys to determine the best locations for long range radar stations to the installation and check out of the latest digital computers. Many other government agencies operate similar services.

IEC Field Service Engineers prepare a portable telemetry system for a polaris tracking mission at sea.

Field service organizations have openings for job skills ranging from engineers to electronic assemblers. In general most hams would be interested in becoming engineers or technicians.

This is one of the few fields where a man can still work into an engineering job title without a degree in engineering. However, this is rapidly changing. If you are planning on becoming a field service engineer you should obtain a Bachelor of Science degree from a recognized engineering school. Concentration should be on applied engineering courses rather than the more theoretical subjects. A Master's degree is just as desirable here as in other engineering jobs. It is especially important if you later decide to change to "in-plant" work.

Requirements for field service technicians vary between companies. In general, the higher quality organizations require two years of junior college electronics, a technical school certificate, or advanced military electronics training.

Completion of military service is advisable for all field service positions as this provides invaluable experience in working with military personnel, and most field service organizations deal directly with the military. In addition, most companies pay a premium to men who have received training in armed services schools on equipment related to their products.

The current demand is greatest for personnel with backgrounds in telemetry systems and metric radar, particularly those with experience in the uhf range. This is due to the big change in telemetry frequencies from the old 215 – 265 mhz band to the 1435 – 1540 mhz and 2200 – 2300 mhz bands. Other critical areas are radar repair and digital data systems.

Field service work may be any where in the world. As an example IEC, the prime

FAA Field Service Technicians aligning UHF receiver banks. In addition to on-the--job training, the FAA provides excellent classroom instruction at the FAA Academy.

contractor for POLARIS/POSEIDON test instrumentation has operations in Spain, England, Guam and at shipyards in the U. S. In addition, they supply personnel and equipment for special operations on ships throughout the world. Men in organizations of this type learn to move fast. Frequently they have to be at a new location thousands of miles away overnight. This type of work demands the development of tremendous versatility. One job may be trouble shooting the latest S-band telemetry system on a tracking ship, the next may be installing missile test equipment on a nuclear submarine.

A well-known field service organization is Philco-Ford's Educational and Technical Service Division. This organization grew out of the famous "Tech-Rep" group. They currently have operations throughout the world, from exotic pacific islands to Viet Nam. The services range from operating missile test ranges to running mess halls!

How do you find out about job openings in field service? Probably your best source of information is the Sunday edition of the Los Angeles Times. Other sources are the trade journals such as the IEEE Spectrum and the Engineering Opportunities magazine. Remember, most big electronic companies have field service divisions. A letter to their personnel offices will usually bring you a list of their openings.

There is a wide range in the quality of field service organizations. Some are little better than hiring halls for semi-skilled technical personnel. Others provide men capable of doing advanced engineering. It pays to carefully investigate before accepting employment. The company's name isn't always indicative of the quality of their field service branch. Arrange to talk with personnel working in the organization, and visit one of their facilities, if at all possible. In general, the smaller the company the greater the variety of work available – and the greater the individual's responsibility.

There are many "pros and cons" to field service jobs. In the asset column you have travel, adventure, the challenge of working on a wide variety of state of the art electronic equipment, working with interesting people and high pay. On the liability side you have extensive travel, complicating your family life, high living costs, wierd climactic conditions, and high pressure work. If you are looking for adventure and are single, the liabilities are quickly overcome! The pay, which is above average, helps, and in most instances there is an additional tax free per diem allowance of from $12 to $25 per day.

. . . W6JTT

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continued from page 7

agers, I frequently find that they have no desire at all to make money. This may be apathy or it may be a reaction to parents that idolized money. It is frustrating though to have what seems to me to be a really simple way to almost unfailingly make a fortune and find that no one is listening.

How long do you think it will really be until we have space stations parked in our skies making wires across the earth a thing of the past? Telephones in the shirt pocket. FM radio and TV from space. Instant accounting down to the smallest store in the country. Letters and photo copies anywhere instantly. The hardware and software for this boom will be manufactured by new companies, and hams will play an important part. The youngsters that recognize this now and get ready for it will be the winners. Ham radio is an excellent start. And courses such as advertised by Cleveland Institute can't but help.

It might be inspirational for the younger members of your radio club if you invited some of the older members who have used their background in ham radio and parlayed it into success to give a talk. If you don't have any real success stories in your club, look around your local area and you'll find them.

Much of the hard work they will tell you about and which is a key ingredient of their success, is education. It may not be in college, but it could be self-education, reading, mail study courses, and brain-picking every expert you can corner.

Before you sit down to write a heated letter hating me for discussing such outrageous ideas, please take some time and marshal your facts. I will bow to documentation and facts, not to steam and emotion based upon disturbed beliefs. As always, I will most enthusiastically publish further thoughts along this line, pro or con.

Reactionaries

The next time you run into someone on the air or at a club meeting that gets mad when you try and discuss methods of improving the ARRL, just remember that reaction is a very normal human condition. The human body tends to reject the transplant of foreign tissue on it. This certainly is rather parallel to the way in which any mind tends to reject any idea which seems unfamiliar or which threatens an existing system. The intrusive forces are sloughed off or ignored, just as an aging lion tamer resists the decision of a circus manager to buy more lions, or just as an executive tends to resist the decision to computerize a business, forcing him to grow into new skills.

Ideas must be presented slowly and cautiously, always equating them to previously understood concepts, if they are to be accepted. It is all too easy to leap into a conversation, as I frequently do, presenting the solutions to problems rather than the groundwork for understanding the problems, which will in turn lead to the obviousness of the solutions. Don't do as I do, do as I say.

Marathon Nets

Bud Massa W5VSR has been registering some legitimate complaints about the overbearing arrogance of some net control operators. His letters are inflammatory, so I'll digest the complaint for you. The problem is that some net managers have gotten the idea somewhere that the net frequency is sacrosanct and that everyone should move off the frequency when it comes net time. After using a certain frequency for some months or years they have developed the strong belief that this is now **their** frequency.

As a strong believer in the value of nets, I recognize that they serve several very useful functions. First of all, by making it convenient for a group of similarly interested operators to get together they make amateur radio more fun for all involved. I'm all for this. Secondly, by stacking a large number of stations all on one frequency with, normally, only one talking at a time, great gobs of frequencies that might otherwise be used are conserved. I'm all for that, too.

There is no question that it is a lot more difficult to run a floating net than a fixed one. When the qrm is heavy, it can be awfully hard to locate a net if it is even a khz off its regular channel. Most of the time, this really isn't true, and the gathering could easily take place plus or minus 5 khz with little difficulty.

Perhaps a little more consideration from everyone concerned will smooth over the

problem before it gets to the FCC petition stage. Net managers could make a try at starting on the net frequency and, if resistance develops, could ask the fellows using the channel to direct net call-ins up or down a few khz to a clearer channel. Four years ago I was given the stiff arm by the net control of the YLRL net and I am still resentful. Let's try real hard not to have this continue.

FCC Actions

RM-1455 is a request for the FCC to return to its previous practice of issuing requested amateur radio calls, when available, when sufficient reason exists for their issuance. It proposes that similar calls be issued to amateurs changing call areas. Thus W1XYZ could request and receive W2XYZ, if available, upon moving to the second call area.

With roughly one fifth of the amateurs moving every year, it would be nice if we could return to the old FCC custom of permitting the retention of the call suffix when changing call areas. Please drop a letter to the FCC backing this proposal so we can maintain our call letter individualities.

RM-1456 is a request for the Technician Licensees to be granted the same A-1 operating privileges as the Novice Licensees. Since the only difference between the Technician and the Novice License is the theory exam, there would seem to be as much value in the Tech having the same opportunity to learn CW by practice on the air as the Novice. Since few VHF receivers are capable of receiving CW, the Techs are robbed of the use of code. We might see many more of them going to the General Class License if they were not bottled up on voice bands.

Please write to the FCC and give them your thoughts on this matter. FCC, Washington, D.C. 20554. Only one copy is required for comments on RM's.

FCC Pronouncement

Since the fall amateur contest activity will soon be here, we believe you will be interested in a resume of a recent explanation of what the Commission considers to be an acceptable station identification, as follows:

For compliance with rule Section 97.87(a), the last transmission of the exchange of transmissions with another station must include that "other" station's call sign. For example "BK 589 CAL TU DX1DX de W6XYZ K" would be in compliance with §97.87(a). When there is a need for identification of the "other" station in an exchange for the benefit of our monitoring facilities, it is most likely to be heard if it is in the last transmission or at the end of a long single transmission.

Where the transmissions of an exchange are very brief, such as the typical contest exchange, if it is less than 30 seconds duration, the entire last transmission is considered the "end of the exchange" for the purpose of compliance with §97.87(a). Provided there is no mistaking which is the transmitting station's call sign, the call signs may be anywhere in such last transmission. While the rule no longer gives examples, continuation of the traditional practice of placing the transmitting station's call sign last or preceding it by "de" is acceptable for this purpose.

Examples of acceptable end-of-exchange transmissions of less than 30 seconds are:

"DX1DX de W6XYZ 589 CAL BK"
"DX1DX W6XYZ 589 CAL K"
"DX1DX 589 CAL de W6XYZ K"
"DX1DX 589 CAL W6XYZ K"
"589 CAL DX1DX W6XYZ K"

For telephony, the voice equivalent of the foregoing examples may be used, substituting "this is" or "from" for "de", etc.

ARRL Questionnaire

Some $37,000 has been quietly spent by the League General Manager out of a fund set aside several years ago for the international protection of amateur radio. Are the members of the League entitled to any accounting of this substantial expenditure? Usually reliable sources-tell us that a good part of these funds have been used for pleasure junkets for top HQ officials. Who is responsible for accounting for these funds? Has there been any evaluation of the international status of amateur radio or of the effect that the spending of this $37,000 has had? When something like this is kept a tight secret it is only natural to worry that there may be a cover-up of skullduggery.

The stockholders of most corporations insist on knowing where the money goes. They demand to know the salaries of the officers and want nothing hidden from them in the published financial statements. ARRL members have, for many years, been asking for the same basic information about their club, but with no success whatever. The truly impressive salaries at HQ are highly classified and subject only to conjecture, even by staff members. If the salaries are reasonable, then why this tight secrecy? What is being hidden?

. . . Wayne

ZL to SM Moonbounce

John ZL1AZR arranged schedules with Kjell SM7BAE during early 1969, but the very short overlap of mutual moon visibility made it difficult. Times and frequencies were worked out, with 144.003 mhz being selected. The antenna would have to be pointed within 2° of the moon. "On our first sked on March 3rd we heard each other at a just detectable level. The next day, at 1728 GMT, call signs were partially copied and at 1746 signals peaked to 12-15 db above the noise. In the next few minutes call signs and signal reports were exchanged to comply with the accepted standards required to constitute an official contact.

"The total useful period was about eight minutes, the moon's elevation was 9° and we think that the extra 3-6 db ground reflection gain due to low angle radiation greatly assisted."

SM7BAE ran 1500 w to a 4CX250R and 16 ten element yagis. The receiver used a 2N4416 preamp up at the antenna. ZL1AZR ran a pair of 4-400's in Class B with about 600 watts output and eight bays of 6/6 slot fed yagis. The receiver had a preamp up at the antenna, and a bandwidth of some 200 cycles.

The signal report system used was a code containing the letters T, M and O. T means that weak signals are present. M means that partial call signs are being copied. O means that both the call signs and signal report have been copied. If almost perfect copy is possible the number "5" is used. Dots are hardest to copy, so dots are only used in the signal reports when good copy is probable. A contact may be claimed if an O level is achieved.

The distance involved was 11,370 miles, a little better than Ray VK3ATN's 10,417 miles.

John tells us, "There is no easy way with moonbounce. Anyone deciding to have a try must be prepared to stop being a communicator and become an experimenter."

The above information is from the Journal of the Aukland VHF Group, via Amateur Radio, the Journal of the Wireless Institute of Australia.

"Up with miniskirts!"

Boy Scout Jamboree-On-The-Air

October 18-19

Held since 1958, the Jamboree-On-The–Air (JOTA) has become one of the most popular events on the annual scouting calendar. Like scouting itself, the JOTA has grown from what in 1958 was just an idea in the head of Les Mitchell G3BHK to an event which every year attracts some 3000 stations in over 70 countries, each with its own little group of Scouts, Cubs and Guides. Some stations have as many as 150 Scouts attending during the 48 hour event.

Apart from its main object in promoting friendship between the boys, the JOTA does have one other major aim–that of introducing boys to amateur radio. It is interesting to find that several hundred boys have obtained their own amateur licenses as a direct result of being exposed to our hobby for the first time during the JOTA. Some of them are known to have gone on and made their careers in electronics and allied fields.

On a world wide basis the JOTA is organized by the Boy Scouts World Bureau which was until early 1969 located in Ottawa, and whose permanent station VE3WSB became a most sought after station, not only during the annual week-end of the event, but also during Jamborees, Exhibitions, etc., to which it was transferred by special arrangement.

In May 1968 the World Bureau was transferred to Geneva. While awaiting the completion of their permanent home, the directors have gratefully accepted the offer of the use of 4U1ITU for the 1969 JOTA.

Thanks to the Bulletin of the Swiss Union of Short Wave Amateurs for the above.

Moving? Please Let Us Know!

Carl Drumeller W5JJ
5824 NW 58th Street
Oklahoma City, OK 73122

Scanning the Flyers

Scanning H & R's Catalog 35

Herbach and Rademan catalog volume 35, number 3 hardly can be classified as a "bargain sheet" in the usual sense of the term. It does, however, provide the widest selection of high-quality electronic and mechanical gear you can find anywhere . . . and often at much reduced prices. As customary, this catalog leans heavily toward laboratory-grade goods. Some of the items are used, but all are in top-class condition. Meter multiplying resistors, at 0.5% accuracy and standard capacitors at 0.5% accuracy are examples of components. There is page after page of General Radio, Hewlett-Packard, Tektronix, and other laboratory-type equipment. These are not cheap. For the amateur constructor, there's a 0-400 microammeter with a needle movement from right to left . . . just the item for a signal-strength meter in the plate circuit of a tube. Another choice article is a miniature 200-0-200 microampere meter, zero center, that mounts with a single ½-inch panel hole. This should be handy for a discriminator or a phase meter. The first-listed is priced at $3.00, the other at $2.00. For a permanent shop set-up you can buy (for $15.00), mounted on a black anodized aluminum panel, 2-inch Weston meters: 0-1 ma dc, 0-5 kv dc, 0-500 v dc, 0-20-100 ma dc, 0-150 v ac. If you're interested in stable frequency standards, how does this strike you? A 500 khz crystal oscillator with a two-stage harmonic amplifier for $5.00; the crystal is in an oven which requires 6.3 v at 1 a; the oscillator and its amplifier need 105 v at 10 ma.

Scanning the Radio Shack No. 189 Flyer

A new bargain flyer always makes interesting scanning. This one is no exception. Several unusual "buys" catch your eyes immediately. Like, for instance, 10-watt resistors in fractional- and low-ohm values such as are needed for power transistor emitters; these are two for 79¢. Their aluminum "mini" boxes are both inexpensive (89¢ to $1.29) and adaptable to many a hamshack project.

It seems that most projects involve transistors. And transistors often are happier if you use a heat-sink when soldering to their leads. At 99¢ for a kit of five, you can buy peace of mind inexpensively, especially when you consider that one of the five has a magnetic base that'll often provide that third hand which nature failed to provide to electronic experimenters.

Although the designers probably didn't have amateur radio in mind, the "Servo-Switch" ($14.95) can be used to good effect by many operators. It comes in two units, both of which plug into the AC power line. One unit, the receiver, sets adjacent to the device you want to turn on. The other is a transmitter that you can take into any other part of the house. If you want to watch a TV program right up to the minute you're due on a schedule, you watch it. But, about ten minutes before "air time," you snap a switch on that little hand-held transmitter . . . and on comes your rig.

The 69¢ packets of small hardware are hard to pass up. It seems that you're always short of some small item. With 28 to choose among, most of your needs can be met.

Scanning World Radio Lab's Catalog

This catalog is unique in at least one respect: It is the *only* one that starts out with amateur radio gear and then drifts into CB and audio equipment! And what a welcome relief it is.

In another matter, too, it is highly unusual. That relates to the wide variety of amateur equipment lines it lists. You might think Leo would push his own excellent line (Galaxy) to the exclusion of others. Not so. You'll find Swan, Drake, Sideband Engineers, Johnson, Ameco, Gonset, Millen,

Waters, Hallicrafters, Collins, National, Hammarlund, Sonar, and a few other but lesser-known brands given quite complete coverage. The prices are right, too. Like many other dealers, you'll find "discounts" (a very naughty word among manufacturers and many dealers) hidden under the guise of inflated "trade-in" allowances. These, of course, apply only in instances of purchases of higher-priced items. Most dealers consider themselves fortunate if they don't have to pay too much to have traded-in equipment hauled off to the city dump; so they can take this loss only when there's a considerable profit on the sale.

This catalog lists quite a number of items that you can't find easily elsewhere. Open-wire transmission lines, copperweld antenna wire, guy wire, three-gang capacitors for pi-networks, coils and switches for pi-networks, and (hold your hats!) ferrite beads! Another item seldom seen is a miniature rotary switch that has a progressive shorting feature . . . a very desirable capability in some applications. Another rare one is an adapter to mate a male uhf connector to a female Type N connector; this for just $2.95.

From the stand-point of a really complete listing of manufactured amateur transmitters, transceivers, and receivers, plus a reasonably good listing of components for amateur building projects; I conclude that the World Radio Laboratories catalog is one of the most valuable available.

Scanning the Poly Paks Flyer

Bargain hunters are getting a glassy look in their eyes . . . that new Poly Paks catalog has just too many attractive "buys" to keep track of them. You can pass over page one, but page two lists a 1.5 A, 2000 PIV diode for just $1.00; it ought to hold just about any power supply for modern transceivers. Page four shows a Fairchild 703 linear integrated amplifier for $1.59. That's hard to beat. Across on page five, you'll see a 23 V NPN transistor, rated to 400 mhz, for 2.99. At that amount, one can afford to indulge in frankly experimental "cut and try" exploration in the field of transistorized transmitters. Page six is a happy hunting ground. There you'll find 15-ohm earphones at 4 for $1.00; 3000-ohm ones at 2 for $1.00. Handsome instrument knobs are 5 for $1.00 in the 2" size and 3 for $1.00 in the 3" size. These are for ¼" shafts. The back cover, really page eight, shows 2N2222 NPN transistors at 5 for $1.00. Considering that these are good for a half-watt dissipation, can stand up to 60 volts or take up to 800 ma (but not both at once), and work satisfactorily at 250 mhz; you'd be hard put to come up with a better source of oscillator, multiplier, and buffer stage transistors.

Scanning the Allied Summer Flyer

Like many flyers, this one tends more toward completed items of consumer's goods rather than components. Nevertheless, it's of interest to the avid bargain hunter. Leafing through it, the first thing to perk your interest may be the $10 price reduction of the Model A-2515 solid-state communications receiver, which makes it an even more desirable item to have around to supplement your amateur-bands-only receiver. Overleaf is an AM-FM receiver for $8.88. This triggers a thought: Why not a converter feeding into this for a nearly no-cost 50 mhz or 144 mhz FM receiver? (More on this later.)

Now for some components. Twelve heat sinks for popular-size transistors for just $1.78 looks like a real bargain. So does a transformer having 6.3-V and 65-V (center tapped) secondaries for only 98¢; this is nearly ideal for transistor experimentation. A wide range of zener dioded at two for 68¢ (1 to 2 W rating) suggests inexpensive voltage regulation for that power supply. And there's a crystal microphone for 88¢! Remember what they used to cost 30 years ago?

Let's get back to that converter-plus-FM receiver combination. This begins to look even more interesting when you read over the specifications for the $29.95 Model KG-220 receiver kit. This has all the goodies that would cost you time, effort, and money if you were to build your FM receiver from scratch. It has a ratio discriminator (none of this slope-detection makeshift), squelch, and slow-motion tuning. Its metal cabinet should provide some measure of shielding, if you were to use it as a tunable *if*. Having both

tubes and transistors, you'd have power available for either type of converter.

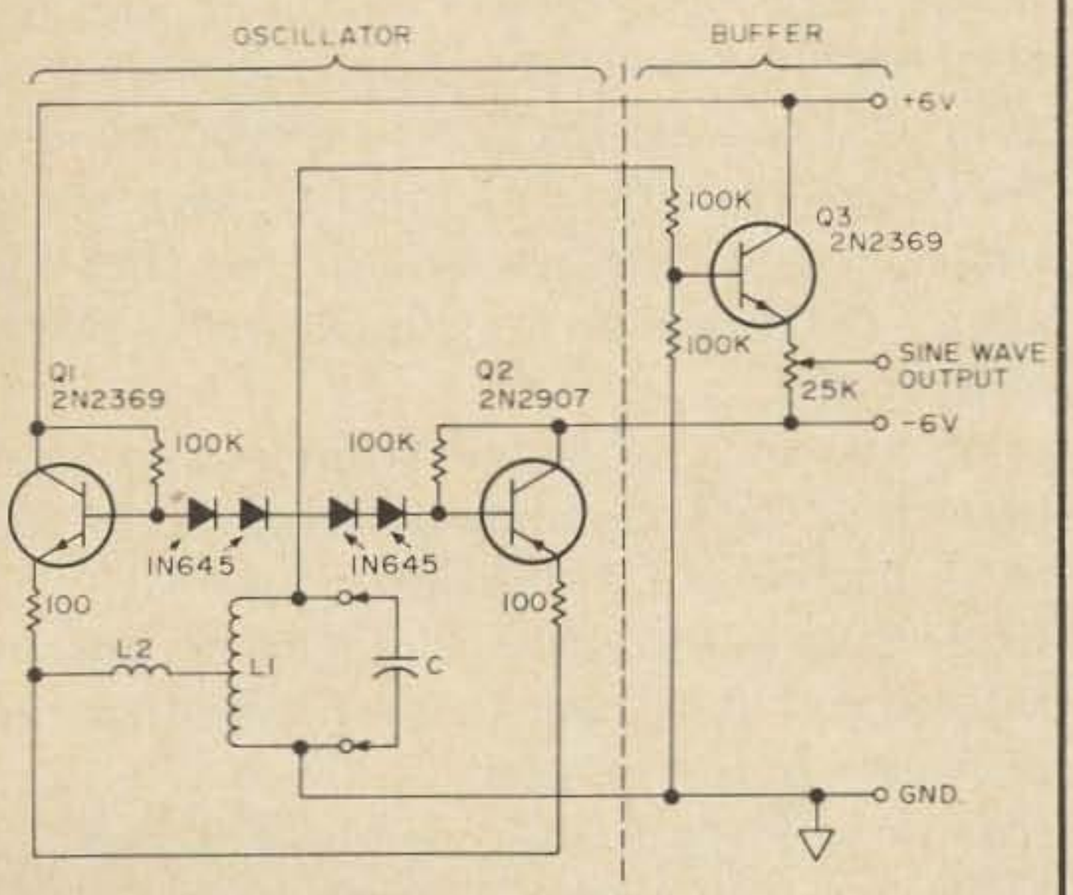
A simple crystal-controlled converter for either 50 mhz or 144 mhz should be easy to design and construct. For local signals, one dual-purpose tube would do the job. Or, if you're really ambitious, you could come up with a converter that would break the squelch on a one-microvolt signal!

Scanning the Olson #769 Catalog

Olson is a firm that issues catalogs at rather frequent intervals; therefore each edition differs but little from the previous one. Catalog #769 lists the usual lines of imports, mostly useful gadgets, but few items relating directly to amateur radio. Of course, crystal microphones at two for one dollar will attract the attention of any amateur who works phone. And if that amateur has a phone transmitter without VOX, he may be interested in spending $14.95 for a hand–held microphone with a built-in six-transistor VOX circuit. As no anti-VOX is provided, he may have to keep his receiver volume low or wear headphones to avoid chattering. Another useful item is a circuit breaker that may be used on everything from low-voltage dc to 117-volt 60-Hz ac. These may be had for 1, 5, 8 or 20 A at prices ranging from $2.99 to $3.49.

. . . W5JJ

Errata



This was left out of the article on page 88 of September. Please cut it out and stick it in.

VHF COAXIAL ANTENNA: all brass complete with 4ft. RG 58/U coax. Tuned to VHF Aircraft, 2 meters and can also be trimmed to other freq. . . . . only $2.95 ea.

FACSIMILE TRANSMITTING CONVERTER: Converts facsimile subcarrier AM to subcarrier FM. Output connects directly to microphone input of VHF AM or VHF FM transmitters. New with diagram, can be used with teletype . . . . . .$19.95.

EARPHONE WITH SWINGAWAY BOOM MIKE: combination. H63 . . only $3.95 ea.

CRYSTAL: 1000kc for LM or BC221 $4.95ea.
200 KC . . . . . $1.49 ea.

2 METER TRANSCEIVER SPECIAL: compact 7"x8"x12", output 7 watts; includes dynamotor & modulator with 10 channel crystal turret: all in this little package.
2 for $35.00 or $19.95 each

SPECIAL:
5" SCOPE: MANUFACTURED BY HYCON Reconditioned . . . each $75.00
New . . . . . each 100.00
HYCON COLOR BAR GENERATOR
Reconditioned . . . . . each 65.00
R-11 LATE TYPE Q5er . . . . . each 12.95

TRADE ONLY

TDQ 2 METER Transmitter also RCK companion receiver, both trade value ($150.00)

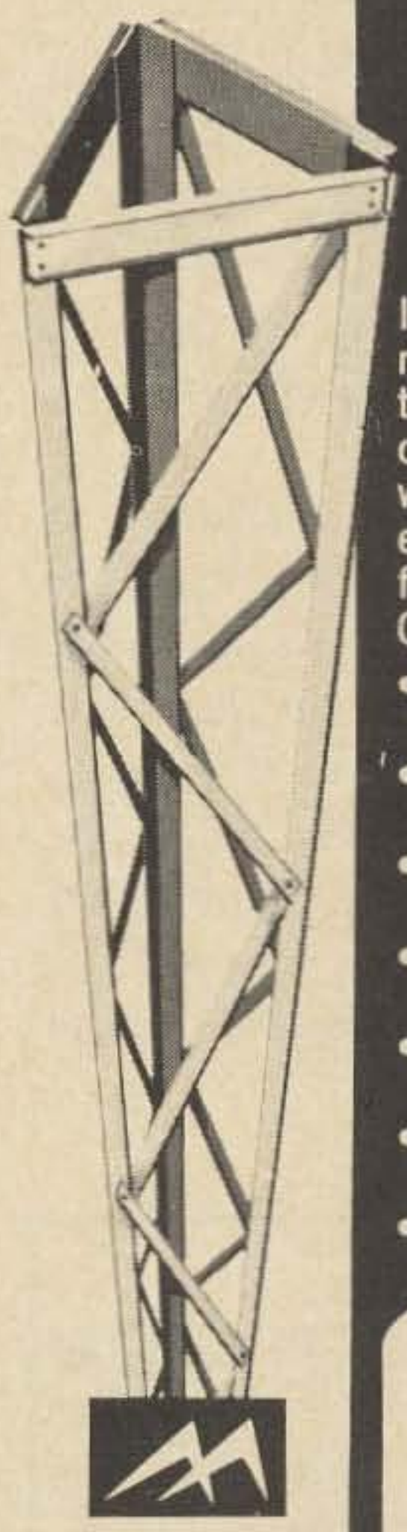
MITE Teletype (cost $3500.00 new) with solid state supply, compact and overhauled . . . . . (trade value $250.00)

TEKTRONICS 531 SCOPE with plug in, in good condition . . . . . (value $530.00)

MODEL 28 ASR Teletype (trade value $750)

Tektronics model 512 less case (trade value $175)

J. J. Glass Electronics Co.
1624 S. Main St., Los Angeles, CA 90015



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Ralph Irace WA1GEK
Assistant Editor, 73
Peterborough, NH 03458

Youth Forum

Today's youth has been speaking out all over the world as it has never before in history. The protests are heard in colleges and even high schools. The pressure is building up and perhaps we can look forward to some explosions in amateur radio.

Youth has been getting the dirty end of the stick from the ruling cliques in many amateur radio clubs. In others, and more usually, they drop out in disgust. Bad scene either way.

The rumble of discontent has been rising steadily at ARRL conventions and the day may not be far away when something breaks. The youth are well aware of the dirty deal they have been getting from the entrenched old timers who are running the League. They've watched the ARRL Incentive Licensing scheme eat dangerously into the ranks of the youngsters and they are angry over the new two year wait for a higher class license. They've watched the FCC figures showing a catastrophic drop in newcomers to our hobby and they point an accusing finger at ARRL HQ.

The rigged ARRL Open Forums at conventions are no longer fobling the youngsters. They want answers. They want action. They want a change in the basic ARRL policies which prevent a Novice or Technician from holding office. They are bitter over the recent change in the by-laws, obviously aimed at them, where the Directors explicity prohibited anyone under 21 from running for the office.

WANTED
AN-URR-13 RECEIVERS
225–400 mc/s Needed Urgently. Highest Prices.
Military Electronics Corp.
11 Summit Ave., E. Paterson, NJ 07407
(201) 791-5050

Have you run into an SCM that refuses to appoint teenage hams to leadership posts (EC, SEC, etc.)? If you run into this, and it is not unusual, unfortunately, then get together with some friends and try and get the rascal out of office. Let him know that you care. If you round up the teenage votes you could well win, because many of the older hams are, sunk into disinterest and could care less even if the hobby continues. They may be dead from the neck up, but you aren't and you can run rings around them.

Teenage traffic nets are fun and informative. They are a step in the right direction. There are only a handful at the moment, such as the New England Teenage Net which meets daily on 3905 at 1900 EDT. The Missouri Teenage Traffic Net meets Monday through Saturdays on 3904 at 1900 CST. The Cornhuskers (Nebraska) Teenage Traffic Net gets together daily on 3982 at 1830 MST. The Tennessee Teenage AM Net works Monday, Wednesday and Fridays on 7280 at 2200 EDT. If you know of more nets please tell me about them.

We really do need a lot more teenage nets, so how about getting things started in your area and passing along the word to me? We could even use a national teenage net if some of you want to bite off a really big chunk to chew on. Sound groovy? Alright, write to me.

In the meanwhile, how about making a big try at getting some teenagers into the SCM chairs. Do you realize that not one single SCM in the entire 74 ARRL sections is a teenager? It is really about time that the teenagers got into gear. It takes only five signatures from ARRL members to run for SCM, you know. Don't let them keep you down forever . . . give them a battle this year!

. . . WA1GEK

DUAL TRANSISTOR IGNITION SYSTEM

This system was made by Canadian Tire to sell for $35.00. These are Brand New fully wired surplus, not rejects. The extra high voltage coil provides smoother running at high speeds and longer plug life, and the lower current through the points makes for longer point life and faster winter starts. Special connector allows instant change over to conventional ignition. Fully Guaranteed, with instructions ready to install for 6 or 12 volt negative ground car. CLOSE OUT SPECIAL

DTI ..... $10.00 p.p.

POOR MAN'S HI FI HEADPHONES

The Canadian Air Force has surplus also and we were fortunate to obtain over 500 headsets from them and are passing the savings on to you. They are unused and in the original cartons. The headphone elements are actually miniature speakers, as pictured, and this is the way Hi-Fi phones are constructed. Will give excellent fidelity with either voice or music. They have rubber pads with chamois-type covering, metal headband, cord and plug. 4 to 16 ohm impedance for use with any radio or TV, etc., by attaching to the speaker leads. May be converted to "stereo" by making connections at each ear phone. This is a real bargain for quality RCAF head sets.

RCAF HP ..... $3.00 p.p.

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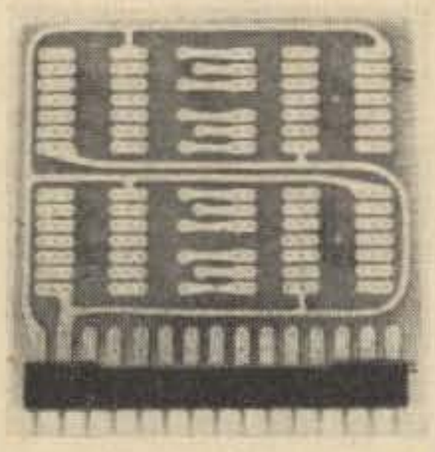
Cast Aluminum case with handle and rubber feet. Threaded bosses inside provides means of fastening items. Toggle clamps provided for ease of opening case. This rugged military case measures 13''x12''x9'' deep. This case will give that professional look to your projects. This case will scrap out at over $5.00 & cost $80.00 to manufacture. QTY. LTD.

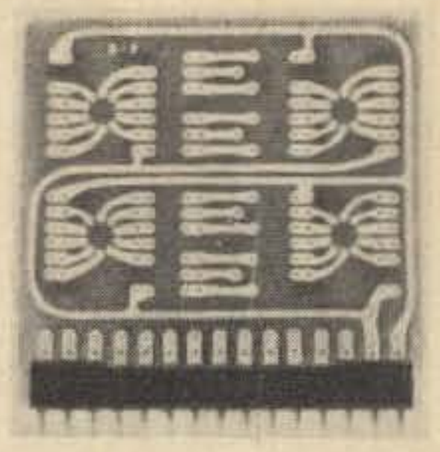
Shipping wt. 30 lbs.

GSEC $9.50

UNIVERSAL LOGIC CIRCUIT CARDS



Instant logic!-!-! for 10 pin TO-5 or 14 lead dual in-line INTEGRATED CIRCUITS



These boards are the most useful items we have ever offered for breadboarding with low cost integrated circuits. The cards are made from 1/16" G-10 Glass Epoxy, with pads for 14 lead dual in-line mounting pads on one side and 10 lead TO-5 pads on the other. 8 lead TO-5 cans will mount in the 10 lead TO-5 pads also. Discrete Transistors and components can be mounted in the locations between the I.C.'s, power supply leads are already routed around the board. Our competitors charge $9.50 each for circuit card and mating connector. We give you a surplus, unused p.c. board with components on it (that you can keep for your junk box), a connector and its mate, and our great circuit card. You drill out the desired hole pattern, unsolder the connector from the surplus card and install it on the new card, wire in the I.C.'s and compute. A few minutes of your time, and you save over 80% of the cost of comparable p.c. cards. Get enough for your breadboarding needs now because these are going to go fast.

2 Cards & mating connectors 2 ICCC $ 2.50 p.p.
10 Cards & mating connectors 10 ICCC $10.00 p.p.
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Shipping wt. 50 lbs. UTT $29.50

SEND 25¢ FOR OUR LATEST, BEST CATALOG YET, JAM PACKED WITH ELECTRONIC BARGAINS . . . FREE WITH AN ORDER . . .

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LETTERS

Dear Wayne,

I believe your honorable draftsman made a small error in the "ultra stable power supply" diagram on page 116. The 1K resistor ought to be in the "down" lead from the +300 volts; the low voltage end of the 1K then goes to solid-state VR and to plate of V1-B.

Neil Johnson W2OLU
74 Pine Tree Lane
Tappan, NY 10983

Dear Wayne,

"The Genesis of Radio Reception" by W1USM in Aug. 73 was most interesting, as it contained the technical information on early radio experiments that history books always leave out.

Bill Hood's excellently written article, however, makes no mention of the American, Nathan Stubblefield, who is certainly not an unknown. On the contrary, Stubblefield must be rated as the most inventive and advanced of the radio pioneers. In 1892, he demonstrated his apparatus which could send and receive voices and music at distances of at least a mile over land or sea. He even built small, portable rigs that equalled or bettered the performance of today's economic marvel of Japanese technology–the three transistor walkie talkie!

This, mind you, was happening several years before Branly learned how to make iron filings fidget in his "coherer," many years before the electron tube or the crystal diode, and quite a while before the eighteen year old Marconi would become famous with his crude spark-gaps and "conveyor-belt" receivers.

I would certainly like to see some information on the circuits and equipment used by Nathan Stubblefield, the apparently forgotten inventor of modern radio communication.

J. R. Johnson WA5RON
5111 Boca Raton
Dallas, TX 75229

Dear Wayne,

After reading your recent editorial about the ARRL proposing to give away ten meters to the CB gang I went on the air and tried to get some letters going to the Directors. Out of 25 contacts only three said that they would write. The others said it sure was terrible, c u agn sn sk.

Russell Platt WA9ZVD
126 Laura Lane
Thornton, IL 60476

Dear Wayne,

In reference to my letter published in the May issue, I would like to thank the many hams for their letters and cards. Everyone received was in accord with my remarks on the incentive licensing issue that was forced on us by the ARRL and the FCC.

As I continue to observe the results of this insidious incentive licensing rule I see how it will have continuing cumulative psychological effects that will be detrimental.

Most hams that do get the Advanced and Extra Class find a coolness towards them when they begin to mention it over the air. The majority seem to feel–well so what, now stay in your exclusive part of the band and don't bother us, there is enough qrm around without your type. So I suggest to the amateurs that wish to waste their time and money taking the Advanced and Extra, keep quiet about it. Just remember the ham on the other end may feel as I do that you have let your fellow hams down–they are sitting this one out because they feel it is a stupid, senseless, undemocratic and unfair ruling that will, if given enough time and is ignored by the majority of sensible thinking hams,, be rescinded as it was before for what it is–useless and a waste of our band allotment.

I suggest hams contemplating Advanced and Extra give the above serious consideration. I would rather keep all my friends than be thought of as a superior big brain and resented.

I sometimes wonder if this was not instigated for the express purpose of reducing the ranks of the amateurs in the United States. Could this be the amateur pill?

One of the truths of warfare is to divide and conquer. They have certainly divided the amateurs, scared off many a newcomer and disgusted many an old timer into hanging up his key.

George Brook Taylor W4PZS
1133 S. W. Fifth Place
Fort Lauderdale, FL 33312

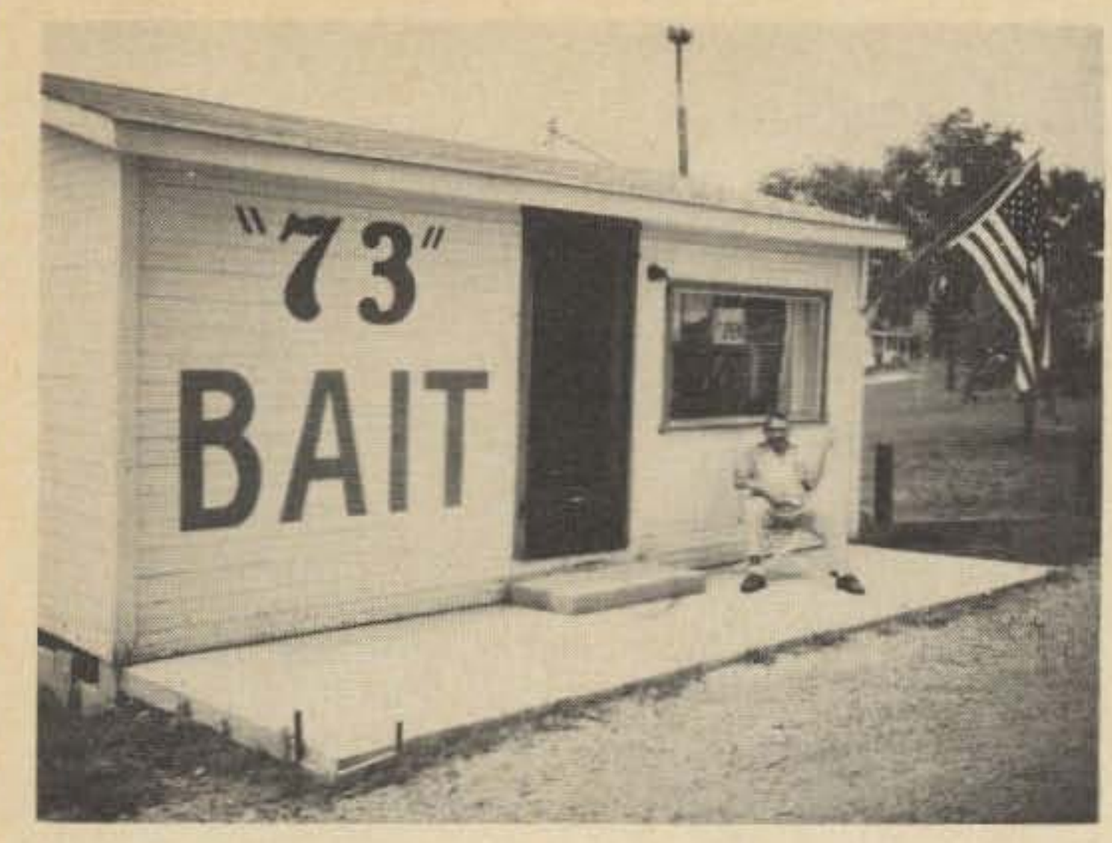
Wayne,

This is just a letter from a member of the younger generation who feels that while everyone's telling everyone else to run a ham radio, he might as well throw in his two bits.

The credit for my original interest in amateur radio goes to Walker Thompkins K6ATX. As a twelve year old in need of a book report I read his adventure story, "SOS at Midnight" and got so excited about it that I read his other books, 'CQ Ghost Ship" and "DX Means Danger,' of my own free will. After following the books' hero, Tommy Rockford (16 year old electronics genius, football player, detective, and superhero–K6ATX), through many exciting adventures, I had learned a lot about ham radio and I was eager to become a ham. As I've always thought that I was a normal twelve year old, I will surmise that other twelve year olds can be equally impressed with Tommy Rockford and ham radio.

Attention hams and ham clubs! Be certain that K6ATX's books or books like them are in every grade school library. But–make sure that in every book is an insert giving names, addresses, and telephone numbers of amateurs in the area who are willing to help people get started, or willing to just show a wide-eyed youngster a ham shack. I could have become a ham five years ago when I read "SOS at Midnight," but I didn't make myself known, and local hams didn't make themselves known.

Duane McGuire
933 Crescent St.
Raymond, WA 98577



Dear Wayne,

This bait store is located about a mile north of Hillsboro, Ohio on state route 73, hence the name "73 Bait." Mr. D. L. Simpkins is the owner and has given permission for you to publish the picture if desired.

We could have "doctored" it up a bit with someone posing with a 75S3 on the end of a line, but thought that this was sufficient to get the idea across.

Paul Terrell, MD W8NTZ
1440 N. High St.
Hillsboro, OH 45133

Dear Sirs:

I noticed the two following errors in the printing of my article "4 Thirty Twoer" in the July issue of 73. In figure 3, the cathode pins (pins 6) of both V_1 and V_2 should be shown grounded. Also, the value (not too important, however) of C7 should be .001, and C_2 and C_3 should have a maximum value of 20 pf. While this may seem trivial, I did receive a long distance phone call from another ham who wanted to know the capacitor's values. His keen interest in beginning the project overwhelmed me, since I hadn't even received my copy of 73 through the mail yet!

Larry Jack WA3AQS/KL7GLK
3 Barry Ave.
Annapolis, MD 21403

Dear Wayne,

Just happened to run across the article ("Kluge Tube") in the March, 1969, issue. As I (along with a few other hams) was deeply involved in the development and mass production of this tube during WW2, perhaps I can shed some light on its characteristics and purpose.

The VT-158 was the brain-child of Dr. (Major at that time) Harold Zahl of the Ft. Monmouth Signal Corps Laboratory. It is essentially a 304TL with increased filament power and temperature (for increased emission) and with rather limited life by ordinary standards.

Although the internal tank circuits may look like they are intended for a frequency of 1000mhz, the operating frequency was 600mhz. The difference being due, of course, to the internal capacitances. Mu was, like the 304TL, in the neighborhood of ten. Power output of the VT-158 was about 200 KW peak, at an input of approximately 1 megawatt, peak. The efficiency wasn't too good, but considering high-power triodes at this frequency, it wasn't too bad, either. Operation was at a plate voltage of approximately 20kv with 1 or 2 microsecond pulses at a repetition rate of 240 pulses per second. The pulse modulator was a rotary spark-gap network-discharge device attached to the shaft of the gasoline-engine driven generator which provided power for the whole system. The audio output from this spark-gap outfit was deafening, and security of the installation must have been negligible.

The radar system employing this tube was, so we were told, part of the D-Day invasion apparatus. Although I was never privileged to see the complete installation, it was reported to have been housed in a tent with center-pole mounted parabola. Its mission was to detect low-flying and dive bombers. As I recall, the prime contractor for the system was W9ZN's Zenith Radio.

R. L. Norton, W6CEM
722 East Gutierrez St., P. O. Box 1469
Santa Barbara, California 93102

Gentlemen:

Recently I've run into some "old timers" who would like to get back on the air. One of the things that seems to give them pause is the new terminology which pervades the ham magazines. Modern electronic magazines are written only for the "in-crowd" who have mastered the new abbreviations that these magazines have foisted upon them. Perhaps I can be of assistance–here is a list of these modern abbreviations, along with the translation of what they *really* mean:

pf . . . not a sneaker–usually, "mickey mice"
μf . . . too small to measure, forget it
cap . . . pronounced "condenser"
hz . . . pronounced "cycles," with one exception–some modernists claim that "hz" is pronounced "Hertz," but who ever heard of a "cycles antenna"?
khz . . . pronounced "Kilocycles"
ghz . . . this horrible-looking glitch is the exception–say "kay-em-cee"
ERP . . . your *rf* ammeter reading times at least 50.
PI . . . a magic number equal to (a) exactly 3 or, (b) exactly the square root of 10 depending upon the equation in which it's used
SWR
VSWR . . . swer or vizwar–this you ignore in quoting ERP–ignore it
FCC . . . means the same old thing–this you can't ignore!

Doug McGarrett WA2SAY
28 Holbrook Road
Centereach, L. I., NY 11720

ITEMS OF TRIVIA

Page 123-124 of July issue appears to have diagrams reversed–right? When I took my 1st class telephone test almost fifteen years ago, one of the questions involved an FM discriminator and all I could remember was where it was grounded. Still remembering only that, the diagram totally confused me until the text tended to clear it up.

I'm sure glad you stay away from space-filling chatter ("Operating News") as one of the other magazines uses, such as W6XXX bought a new call book, or WA3XXX put some new finals in his linear. Seriously, the Pickering Radio people have an excellent product in their code practice tape, and after seven weeks of intensive work, I passed

the FCC test. The Pickering tapes should receive enthusiastic endorsement. (WA6CPP passed his advanced exam . . .)

Paul Schuett WA6CPP
14472 Davis Road
Lodi, CA 95240

Dear Wayne,

I've been reading your *73 Magazine* editorials; and I like your frankness and open-minded views, so I'm writing to express mine.

Just a little background so we talk the same language. I've been interested in ham radio since I bought my first receiver in 1933 for $33.00. Twenty-seven years later I sold it for $30.00 to a young fellow trying to get his ticket, and it worked like new.

Over the past years, I've belonged to several radio clubs and have helped many a ham get his ticket and a TVI free rig on the air. Why not, ham radio *has been* and still *should be* the best hobby, and it is a good investment for our country. You'll notice I said has been and should be.

I consider the years up until the early 1960's the Golden Years of ham radio. Those were the days of home brew equipment and comradeship. Fifty or seventy-five miles was not even considered when it came to helping a fellow ham de-bug his rig. The accomplishment and the feeling of pride one received when he heard "old Virg's" rig on the air made ham radio have a meaning. To sit up half the night and work on a piece of equipment while ragchewing with a mobile or two that were following the local H. S. or college team bus home through a storm was just part of being a good ham. Integrity, responsibility, and justifiable pride were a part of the teaching to be a good ham that was given each new ham. He knew if he did not measure up he would be dropped.

In the early 60's several things began that have changed the conditions and attitude of ham radio. The two major ones were the introduction and acceptance of CB radio and SSB ham radio. Progress is inevitable and new things will come out. To classify or not, CB or SSB as good or bad is not really the issue, as both have their good and bad points. To point out the real issues, I will give an example that happened to me. Many (too many) similar examples have happened since; and I got to thinking.

After successfully building my own, mobile and home, AM & FM rigs and could use the home rig as a relay station, I figured I'd try SSB. Some surplus xtals and equipment and many moons later I had an excellent workable rig with a grounded grid (4-1625's parallel on 75 mtrs.) on the air, TR switch and all. My first contact (outside local) gave me a good report at first but when we exchanged Q-th equipment types he never came back. Later (several days) I heard him ragchewing with another station, and he said he was not about to talk to anyone who didn't have top line (no commercial names) equipment. If the sigs weren't coming in S-9+ he wouldn't even answer them. As I said, this happened so many times to me that I began to say I had "top line" equipment. Then I really started thinking. Is this really ham radio?

Where had my integrity and pride of accomplishment gone? This is not the ham radio for me. So projecting a long look far into the future I could see only one workable plan to keep ham radio alive and with something to look forward to. So I began to express myself at clubs and on the air. Several old timers were with me, but that was the support I got.

About this time CB radio was blossoming and (even through 1968 this is still happening) young high schoolers and the college set found they could get on the air for $40 to $100 mobile or fixed station and no code, not even an exam for a license; and they could yak away to anyone in the country. The cost of SSB equipment for a mobile rig is from $300 to $500 and if they get that kind of money they invest it in wheels, a bomb or some sort, and then maybe, I say maybe, a CB rig. It's easier, costs less, and they have less restrictions. They can even get a 65 watt transmitter for around $50; so who needs ham radio? Facing this reality, how does one go about getting them interested in being a true ham.

One young (H. S.) fellow purchased a SSB transceiver and before he had it paid for it was obsolete (pwr. & selectivity wise) and his trade-in would be a lot less than he had a right to expect so, he operated as is. Try selling ham radio to some of these youngsters and they may go so far as to invest in a novice Tx & Rx and for a short time they enjoy it; then they find the temptations and the going tough. They have invested in low power AM equipment and have a hard time selling it. They key up and get a 2 or 3 word per min. contact and then the return op comes back with 10 or 15 w. p. m. and they get discouraged and start tuning up the bands; and soon they find the CBers are having a ball. Knowing most of them, he finds he can get a xtal and pur his rig on with the rest of them. Another ham lost.

It's not hard to see today's problems, or mess, or hangups, or what ever you call them, they are real and definitely with us. So once again I'll propose what I feel is a solution to our problems. I know I'll get a lot of static but then I'm used to it by now.

The main thing is to think for the good of ham radio and not for the good of oneself.

With SSB and RTTY proven to be fast and superior to CW why not leave CW out of the picture (except as a rider). All hams should by exam prove they know theory and good operational practices. All hams should be general class and use any band *but be restricted to 250 watts input or pep power.* (No more spiraling of power and price out of the reach of the junior and the overseas ops.) After 3 years of a general ticket and, the building of a complex workable piece of equipment plus an exam one could get an advanced ticket that would entitle him to put a kw on the air on any band.

Area clubs who have at least one advanced ticket holder *as an officer* would and should be permitted to give the exams. They would also have the responsibility of updating the hams in their area and of policing (if I may use the word) the same. For the ham to again be looked upon as anything but a nuisance he must accept the responsibility and let those who can perform be the liaison between the FCC and the ham. The local newspapers are supposed to be for the good of the people they serve, so, why not have local committees or representatives to approach the local hams and CBers who are directly violating the rules and privileges of the area and print their name, address, and call in the local paper for a week or so. If they don't conform then let the FCC designate the action to be taken.

Active clubs with dues and a place to use

modern equipment are a must as technology has advanced beyond the stage of each ham owning his own test equipment or of (in many cases) the ham even repairing his own equipment. If we don't pull together, we will be (as we are now) pulled apart.

As the first part of this letter explained, hams had a sense of togetherness that comes by doing things together, especially *working together*. We can no longer push the "on" switch of a high priced piece of equipment and be just appliance operators. If all we put into ham radio is money, I don't think we can expect much out. I was always taught the things worthwhile in life came from the heart and only the heart. All else just comes and goes.

So what say, fellows, lets put a little heart into ham radio and once again make it a worthwhile thing.

Wayne, I know that you and the rest of the staff will kick this around. Hop in, the band is open.

William A. Gardner W8EAU
5704 Decker Road
North Olmstead, OH 44070

Dear Sir:

Why doesn't your magazine run a series of articles on computer and binary logic as applied in Integrated Circuits. There are very few hams that can boast even the slightest familiarity with computer logic and I. C.'s. It would be nice to have a series of educational articles of the same quality as the "Getting Your Advanced Class License" in the past and now the "Getting Your Extra Class License." Thank you. I got my Advanced License thanks to your study course.

John C. Koning WB6VQE
4680 Crestview Drive
Norco, CA 91760

Sounds like a loser to me; any other votes on this? . . . ed.

Dear Wayne,

Glad to report the acquisition of the "EXTRA" ticket recently!

Biggest factor towards getting it was the great articles on obtaining the "big" ticket. They are written so the "self-taught guy" can grasp it—no technical terms, (or at least very few) very explanatory, and really "step by step.' Other magazines are great if you're in electronics, or have an E. E. degree, but as for me—I needed some "plain ol language" descriptions!

I found 'em in the articles and must say "thanks a lot" to the staff's effort.

R. J. Renart WB2AUF
117-09 9 Ave.
College Point, L. I., NY 11356

Dear Wayne,

In August issue, page 98, on output section, on leads going to the meter, a diode was left out (any small diode) for the rf output meter.

Thought I'd bring this to your attention before someone else did!

Bill Eslick, KØVQY
2607 E. 13th
Wichita, KA 67214

Dear Wayne,

During the past many years I have enjoyed amateur radio to its fullest degree. I have met some of the finest persons in amateur radio—and a few of the others. The spirit of maxim and others has carried amateur radio for decades. Today we need

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a regeneration and real vital vitamin shots to maintain the privilege of amateur radio operation throughout the world.

The value of your efforts in publishing the magazine "73" is of tremendous value in preserving amateur radio as a hobby and as a public service. Many of us are grateful to you and to your staff for a job well done–but one that must continue.

John Tracy, W1GH
49 Broadway
Taunton, MA 02780

73 Editor,

I wish to express my thanks and congratulations on such a fine Advanced study course. I at first tried to learn from another well known publication, which need not be mentioned, and did nothing but memorize the answers as you said would and did happen. I am now using your Extra study, but because of the asinine 2 year wait for so called experience is keeping me back another year. Anyway thanks again for such an outstanding study. You should publish the courses under a different cover. I am sure you would have a great success with it.

Robert McGwier, Jr. WB4HJN
P. O. Box 565
Grove Hill, AL 36451

Good idea . . .ed.

Dear Editors:

Congratulations on your decision to cover allied fields with separate publications. While there are a great many hams who use CB radio (to good advantage), and many who follow the SWbroadcasts, they would do better advised to subscribe to magazines in their special interest. I do not wish to hunt through SWL or CB news to get at the Ham articles. And those with one of the other special interests should not be so burdened.

I recently checked an issue of QST and found about one third of it of interest to me. There are a great many Hams who are interested in contest news, organizational matters and other items which do not appeal to me. I do think QST does a fine job of covering this wide area. They have, however, fallen victim to a common failing of such publications (yours excepted). The people who write about articles they would like to see, but never bother to write that letter. Since the desired articles are usually advanced engineering, the Editors get the erroneous impression that their readers all want it. They forget that they must attract more readers, and they necessarily will come from those just starting.

Your study courses have been by far the best "Self Help" courses I have seen. With the traditional Q & A approach, there is too much tendency on the part of the student to try to memorize, rather than fully understand. There will always be a demand for the "quick and easy" memory course. From this group come our appliance operators, although many do go on to learn, and build.

Lester Ulch WB4HPB
1248 Haven Dr.
Birmingham, AL 35214

Dear Mr. Green,

Having been a charter member of your institute of amateur radio, and followed with enthusiasm the meteoric rise of 73 from its inception, this letter is addressed to you because it is felt that it

from the all-new, still unpublished "FM Repeater Directory," which is updated continuously and published quarterly in FM Journal.

Ken Sessions K6MVH
Editor, FM Journal

Dear Wayne,

Yes, quite a few of us are out here want to be able to use more, not less, frequencies. Opening 3650-3700? Now that would be incentive and would give us all a lift. I know that my operating has dropped off, way off, since last November. I find myself squashed toward the high end of the band, hearing how great it is back on the low end where I operated for the past 19 years. Yes, open something new. It certainly would cut down the QRM. And what about this VHF beacon for W1AW? What good is that going to do me? We sure do need something to spark up amateur radio, but I don't think the punishment we have been getting is the answer.

.... John W4AEG

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will, at least, receive some kind of consideration.

The subject: the QRM problem and crowding on our phone bands. It is time we press for remedial action. Incentive licensing certainly did nothing for this problem. At the crux of the matter there seems to be a glaring inequity in the frequency allocation that confines the U. S. amateur to a portion of the phone band, while foreign stations have full freedom of the range, so to speak.

Late callbook figures show the U. S. amateur total to be near 290,000. While foreign registrations, not including Russians, are near 137,000. If we are the greater in number, and confined to the area of the North American continent geographically, why should we be penalized for our numbers? Why should special portions of the phone bands be pre-empted for foreign use?

If you tune across the American portion of our phone bands on most any weekend, you'll find something that pretty well borders on bedlam. While tuning the foreign portion of the band, you'll find vast empty spaces there.

At the time these frequency allocations were made for our phone bands, our numbers were not such as to create any problem. Today, even with our sophisticated equipment, the frequencies available are not adequate for the prevailing demands.

For a long time that has been a rather taboo subject; however, it's time to open up Pandora's box and let the thing out for an airing.

We'll never get our share unless we're in there fighting for it. It's time now to pick up the cudgel, pen and microphone to join in a combined assault on an unfair, outmoded agreement's bailiwick.

W. A. Hanks WØKJ
Tebbetts, MO 65080

Dear Wayne,

Congratulations on a beautiful issue (August 1969). I particularly enjoyed your FM articles; the timeliness of 73 in covering the "in" aspects of our hobby never ceases to amaze me. You people always seem to be "right on top of it."

Referring for a moment to the article, "FM–Fun Maker": Lest 65,000 anxious amateurs run out quick and buy crystals and FM units based on the author's stated popular frequencies, I think it advisable to contradict one small point. The author says:

National repeater frequencies are 52.80 in, 52.72 out for six meters and 146.34 in, 146.76 out for two meters.

Prospective FM operators should be advised that in the United States and Canada there are 106 repeaters whose output is on 146.94 mhz. There are only 29 repeaters in these areas with output on 146.76. For my money, 146.94 mhz could hardly be considered anything other than THE national repeater output frequency. Also, I know of only two six-meter repeaters in the entire country with an output of 52.72, and one of them is keyed from two meters. But there are 18 with an output of 52.525 mhz.

Like many other FM'ers, the author of the above-referenced article obviously does not like repeater outputs on national simplex channels. But he can hardly change the facts by ignoring them.

As a miscellaneous tidbit of nonessential information, there are 234 open-access repeaters in the U. S. and Canada. Nearly 200 of them are on two meters. All information given in this letter is

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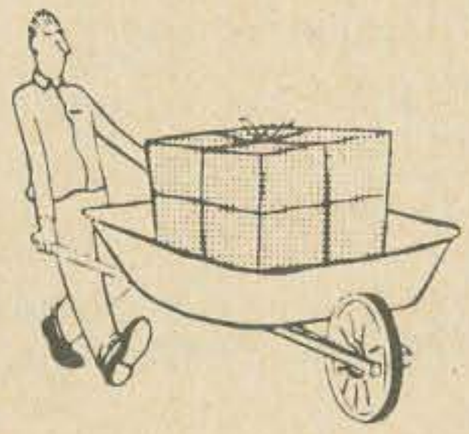

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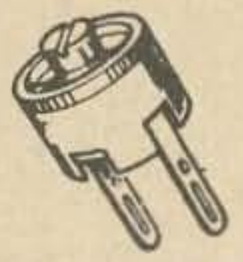

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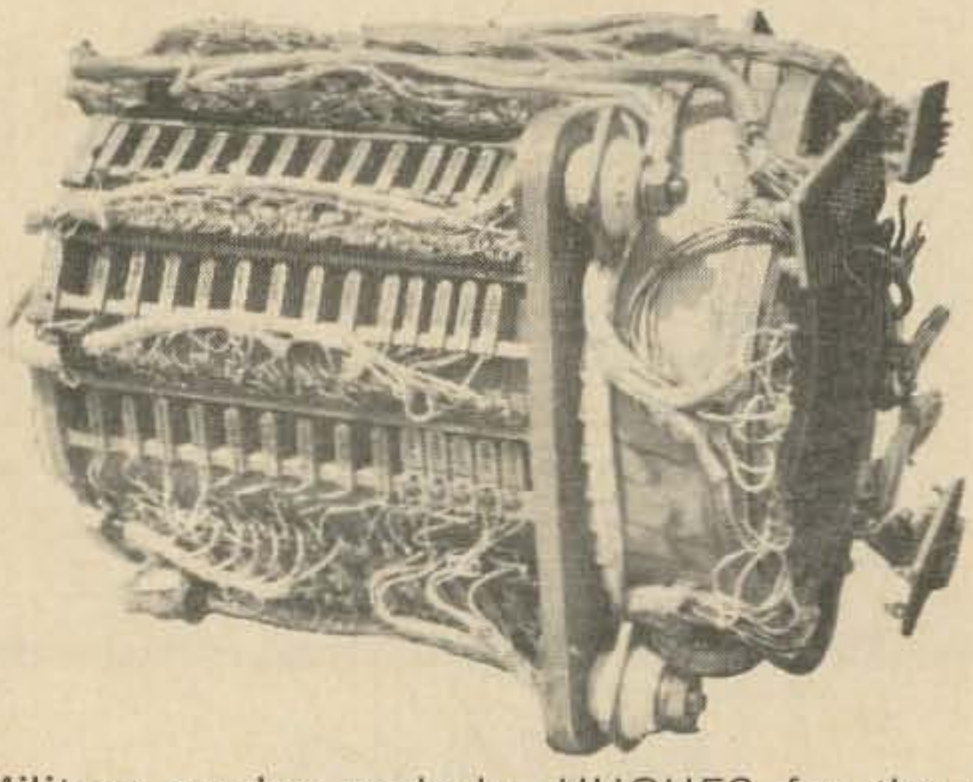
#N300 2.5-11 pf
#NPO 5.5-18 pf
#N650 9-35 pf

$6,400.00 MEMORY DRUM



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914	Dual 2-input gate	1.00
914-925	Dual 2-input gate dual expander	1.00
923	JK flip flop	1.00
925	Dual 2-input gate exp	1.00
946	DTL 4 2-input NAND/NOR gate	2/1.00
	DTL Clocked flip flop	2/1.00
1M5	Dual 4-input logic gate	2/1.00
7M6	6 NPN transistors in one package, gen use	3/1.00
12M2	Diff Amp	1.00
711	Dual Comp Amp	2.00

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MANUALS–TS-323/UR, TS-173/UR, BC-638A, R-274/FRR, TS-186D/UP, SSB-100, LM, $5.00 each. Hundreds of others. List 20¢. S. Consalvo W3IHD, 4905 Roanne Drive, Washington, DC 20021.

TEXOMA HAMARAMA! The annual Texoma Hamarama will by held again Nov 15-16-17 at the beautiful Lake Texoma State Lodge. Plan a pleasant weekend for all. Bring the family. Mail registration fee of $2 per person to: Texoma Hamarama, PO Box 246, Kingston, OK 73439.

GREENE . . center dipole insulator with . . or . . without balun . . see September 73, page 41.

QSLS???? Largest variety samples 25¢. Sackers, W8DED, Holland, Michigan 49423.

WANTED MODEL 28KSR in good operating condition for $250.00. K. Schwieker K4KQR, 1124 Opelika Road, Auburn, AL 36830.

HEATHKIT SB-110 and Power Supply HP-23–Like New–$270.00. Charles Kehler, 1067 Western Ave., Green Bay, WI 54303.

SSTV MONITOR, 12 transistors, 5 tubes, 3RP7A CRT, Bud Portacab cabinet, tuning indicator, $190 plus shipping costs, Cohen W4UMF, 6631 Wakefield Dr., Alexandria, VA 22307.

COLLINS 75A4, Serial 2530. Excellent condition. Best offer over $300.00. Paul Delaney WB6BOQ, 1328 Calle Pimiento, Thousand Oaks, CA 91360.

FOR SALE: HT-37-HT33A, 2000 watts, PEP. Original owner. Good condition. $250.00. Pickup only. Fred Fetherolf, phone 614-332-3421, Laurelville, OH 43135.

ROCHESTER, N. Y. is again Hamfest, VHF meet and flea market headquarters for largest event in northeast, May 16, 1970. Write WNY Hamfest, Box 1388, Rochester, NY 14603.

VHF ROUNDUP Syracuse vhf roundup Oct. 11, 1969, Three Rivers Inn, Rte 57, 10 miles north Syracuse. Tickets, W2RHQ, 902 First North St., Syracuse, NY 13208.

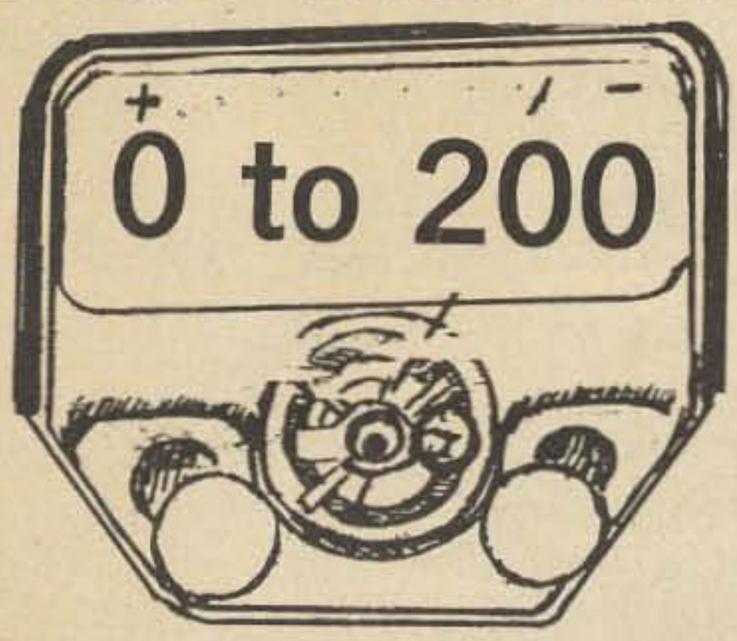
TELETYPE PICTURES FOR SALE. 50 pics for $1.00. Perforated and audio tapes available. Write for prices specifying speed and tracks. Pictures to be included in second volume solicited. W9DGV, 2210 30th St., Rock Island, IL 61201.

WARREN COUNTY N. J. W2JT/2, October 18-19, 3555, 7055, 14055, 21055, 28055, 3855, 7255, 14255, 21355, 28555. QSL to W2 bureau.

HILLSBOROUGH AMATEUR RADIO SOCIETY, INC., (HARS) Annual Tampa, Florida Hamfest, Sunday, October 12, 1969, Lowry Park, Sligh Ave. & North Blvd. Free Parking–Many Prizes.

SELL: ART-13 Transmitter with maintenance manual, connectors, spare 813, 837, and 811's; $40. RME 435A Receiver with book and some spare tubes; $60. PCA-2 Panadaptor, 455 khz, with book, needs work; $5. You pay shipping. K9KRW, Box 436, Highland Park, IL 60035.

MICRO AMP METER $1.95



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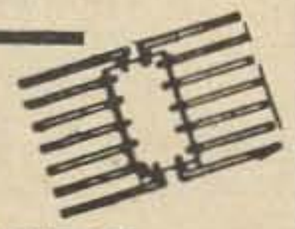

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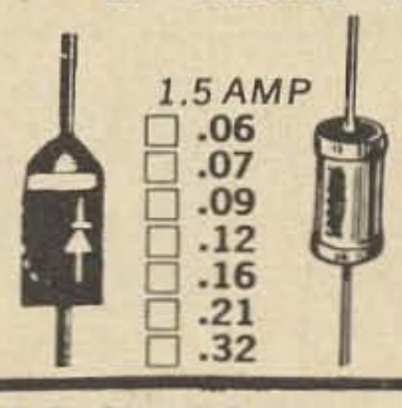

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400	☐ .12	☐ .12	☐ .31
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*1.5 Amp rating

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	100	☐ .07
	200	☐ .09
MICRO	400	☐ .12
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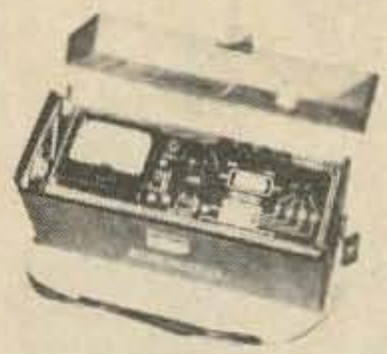

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